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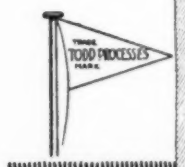

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The Physical Society and Research.

LAST week the Physical Society of London celebrated the jubilee of its foundation with a series of meetings, culminating in a banquet on Saturday, at which the Duke of York and the Prime Minister were present. Delegates from other scientific societies, both at home and abroad, attended the meetings, and the proceedings were conducted with a dignity and tone fully in keeping with the importance of the occasion. The Society is but little junior to the Institution of Electrical Engineers, with which it has cordially co-operated, the bonds between them being exceptionally intimate and strong. Indeed, it is perfectly true to say that physics is the foundation of electrical engineering, whilst the latter in return has exercised profound influence upon the former—nearly 80 per cent. of the 183 devices which were shown in the exceedingly interesting exhibition of physical apparatus at the Institution last week were either wholly electrical or magnetic, or depended upon electricity in some way for their operation.

Whilst tendering our most hearty congratulations to the Physical Society on the completion of its first half-century, we would take the opportunity of further emphasising the immense importance of physics to the industry with which this journal is associated. It is a matter which we have often impressed upon our readers' attention, for the very soul of physics is research; the physicist is constantly opening up new fields, and more often than not it is the privilege of the electrical industries to cultivate those fields and raise a harvest of new means and methods for improving the lot of mankind. The development of those applications of physics to industry itself demands research, but of a different order; for the latter is undertaken with a definite object in view, whilst the former is embarked upon in the spirit of exploration in the regions of the unknown.

The point which we wish to drive home is the fact that the one is just as necessary as the other. Discovery must precede development. But it is one thing to obtain funds for the prosecution of research with the prospect

of an immediate return on the investment, and quite a different matter to finance research "on the off-chance" of effecting discovery. Owing to "England's neglect of science," so earnestly deplored by the late Prof. Perry, the public mind in this country does not appreciate the merits of the question, and though the experiences of the Great War to some extent enlightened public opinion, the nation, whose chief characteristic has been described as forgetfulness, is in danger of relapsing into its traditional indifference to the study of science. Yet, in spite of the handicap under which they have always laboured, our scientists have more than held their own with those of other nations, and to this day they are in the very forefront of scientific progress: What could they not do, then, if given the opportunity? As Dr. Russell pointed out at the dinner of the Institution of Engineers-in-Charge the other day, it is not the number of laboratories that counts so much as the quality of the researchers, and ours are of the highest ability.

Under the ægis of the Department of Scientific and Industrial Research, supported by the splendid work of such bodies as the Institution of Electrical Engineers and the B.E.A.M.A. (as well as by the big manufacturing concerns) in our own industry and similar societies in other callings, "industrial" research is well established, and has proved capable of producing most profitable returns on the outlay; but "scientific" research, or more correctly research in pure science, is apt to be cold-shouldered, even by the department above-mentioned.

The jubilee meetings of the Physical Society, fortunately, have received very wide publicity, and the distinguished patronage with which they have been favoured will further help to attract public attention to the subject. Moreover, at other public functions recently the importance of research in pure science has been repeatedly emphasised, as our pages have borne witness. We were particularly pleased to see that Mr. B. Longbottom, in his address to the B.E.A.M.A. to which we refer below, laid stress on the absolute necessity for research on economic grounds, and showed that the study of pure science had a direct bearing on electrical manufacture. The pressure must be maintained, and no opportunity should be missed by those who have the interests of their country at heart for explaining the need for research of the right kind, and the importance of supporting it with adequate funds.

The Electrical Industry Reviewed.

The speech delivered by Mr. B. Longbottom, chairman of the B.E.A.M.A. Council, which is reported later in this issue, forms a useful and authoritative review of the present position of the British electrical engineering industry. The report of the Executive Committee, which we give in abbreviated form, is a record of the work done by multitudinous officials and committeemen—the fact that as many as 1,000 meetings took place during the year provides some indication of the enormous amount of detail that has to come under consideration. It is an account of the stewardship of the Executive, but it is necessarily a formal and somewhat dry document—not nearly so full of life as the speech of its very energetic chairman. We have no intention to refer in detail here to either the report or the speech. Both are well able to speak for themselves. Mr. Longbottom said it had occurred to him that interest might be added to the annual meeting if he gave a short address on the year's progress in the electrical and allied industries. He hoped that succeeding chairmen would forgive him for the innovation, and not feel bound by it. That it has added interest to the proceedings is indisputable, and we hope that later chairmen will see the wisdom of following the example. Mr. Longbottom's utterances possess the merit of being a review of the situation right up to date, and they may be regarded as focusing the majority of Beama thought. The state of industry, the favourable position of the electrical as compared to other industries in regard to employment; the importance of research to our efforts to produce efficiently and economically in order effectively to meet foreign competition in the markets of the world; the keenness of competition in the Home market; the changing conditions in some foreign markets where former purchasing communities have been caught in the wave of nationalism and are manufacturing for themselves; the hopeful electrical outlook in South America, where the long period of financial depression is now felt to be ended; the importance of Imperial Preference in some form or other; and the value of the British Empire Exhibition as a means for displaying to Dominion and other overseas buyers the electrical and allied productive capacity and skill of our works—these are all topics of immediate interest to us all, and we believe that every reader will be profited by reading every word of the speech.

Illuminating Engineering.

Illuminating engineering, though applicable to all illuminants, is a subject of special interest to the electrical industry. Mr. Leon Gaster, in his informal talk at the Institution of Electrical Engineers, on March 17th, referred to many recent developments in the lighting of shops, factories, mines, railways, &c., some of which were further illustrated in a series of slides shown by Mr. J. S. Dow. In all these developments, we need not fear, electric lighting will get its share, but success will depend mainly on the readiness with which manufacturers, supply authorities, and contractors fall in line with progress and exploit scientific methods. Meantime, any movement designed to stimulate public appreciation of good lighting should receive the wholehearted support of the electrical industry.

Mr. Gaster pointed out quite plainly that there are many problems that cannot be effectually solved by the unaided efforts of makers of lamps and fittings. Firms in the lighting industry can do, and are doing, useful educational work. But the most powerful lever with which to move the public is that applied by persons or bodies "with no axe to grind." The desirable conditions of illumination in important industries should be settled by consultation with their representatives. Experts on lighting must confer with the user. Government Departments must be approached on independent and impartial lines. Illumination, it may freely be agreed, is something different from a purely technical electrical problem, which can be safely left to experts. The human element must be taken into account, and problems involving large sections of the community must be treated on broad lines. Independent effort should be welcomed as an educational force by which all those concerned with lamps and lighting appliances stand to benefit.

Electric Smelting of Iron Ore in Norway.

During the past 20 years, the question of the extension of the production of iron or steel in Norway has engaged the attention both of private individuals and of the authorities of the State; this was particularly the case during the war, when supplies of iron and steel were difficult to obtain from other countries. But the war came to an end without any definite steps being taken in Norway to bring to a successful issue any of the schemes which were advanced for the production of iron from native ores, and it was not until October, 1921, that the Government allotted a sum of 150,000 kroner for the purpose of carrying out an experimental installation at the Fiskaa works, at Kristianssand. The Department of Commerce appointed an expert committee to supervise the work. Experimental operations were continued until early in January of last year, and thanks to the co-operation given by the Christiania Spiger Verk (nail works) it was possible for the chief engineer concerned with the trials (Mr. Tysland) to obtain such good results that the Christiania Spiger Verk now proposes to construct an electric furnace of 4,000 kW on the system used in the experiments already mentioned. The Department of Commerce has agreed to place at

the disposal of the Spiger Verk all the information available concerning the experimental working at the Fiskaa works, subject to the condition that one of the State engineers shall be permitted to follow the working of the proposed large new furnace in the first year of its activity, and the State shall be able to utilise the experience gained during that time for the benefit of other Norwegian works. The circumstances in Norway at the present time are such that there can be no question of the erection in the near future of large iron-works and rolling mills, but the pig iron which the Spiger Verk intends to produce in the new furnace is to be used in connection with the company's existing open-hearth steel works and rolling mill.

The results of the State experimental work in the electric smelting of iron ore were recently placed before the Polytechnic Institute in Christiania, by Mr. Georg Tysland, the engineer chiefly concerned in the matter. It appears that with the assistance of a "continuous electrode," patented by Mr. C. W. Soderberg, it was considered possible to construct a simplified furnace of a large capacity, adapted for the melting of various kinds of Norwegian raw materials. The trials were conducted in 1922-23, with different kinds of ore of which a total of 2,200 tons was smelted. Having regard to the chemical and physical qualities of the ores it was found that the consumption of electric power varied between 3,500 and 2,600 kilowatt-hours for the production of one ton of pig iron, while at the same time the consumption of the reducing materials, converted to a standard coke quality with 85 per cent. of fixed carbon, was between 435 and 320 kilogrammes. In the opinion of the engineer it would be possible, under average conditions, to reckon in Norway upon the following consumption: Electrical power, 2,700 kW-hours per ton of iron made; coke with 85 per cent. of fixed carbon, 380 kilogrammes per ton of iron; and electrodes from 8 to 10 kilogrammes per ton of iron. Various qualities of iron were produced during the experiments, suitable for foundry work and for conversion into steel. The total production of pig amounted to 1,300 tons, of which about one-third was delivered to various foundries; not a single complaint was made with regard to the quality of the iron, but on the contrary favourable expressions of opinion were received. The remaining two-thirds of the output was delivered to the before-mentioned Spiger Verk for manufacture into steel.

It is then on the basis of the preceding results that the Spiger Verk is now to undertake the construction of a furnace of a capacity of 4,000 kW. The principal of this works states that the installation will permit the company's steel works to attain to a production of 30,000 tons of steel ingots per annum, corresponding to about 27,000 tons of steel bars; and with a slight alteration of the steel plant it would subsequently be possible to turn out 40,000 tons of steel ingots or about 36,000 tons of bars per annum, which would represent from 55 to 70 per cent. of the bar steel imports into Norway in 1913.

Electricity Supply and Industrial Progress.

The Batti-Wallahs' Society, which during recent months has been restored to its pre-war vigour, at its annual dinner last week had the privilege of entertaining Mr. Frank Hodges, Civil Lord of the Admiralty, who holds strong views on the subject of electricity supply in this country, and expressed them freely. Mr. Hodges, who has seen what other countries can do with the aid of water power, feels that Britain is lagging behind in this respect, and lays the blame on the individualism which characterises the race, appealing for the co-operation of all parties in order that electricity supply may be developed on the largest possible scale.

That co-operation is essential to progress cannot be denied; the time of the Electricity Commissioners is largely occupied with endeavours to induce the various supply authorities to come together for the common good, and they have met with no greater obstacle than the reluctance of some municipal undertakers to merge their individualities and to curb their local ambitions. But it should not be forgotten, as Mr. C. H. Wordingham pointed out, that until the Act of 1919 was passed, the trend of legislation had been diametrically opposed to co-operation, and it had been the policy of the Government from the earliest days to encourage the subdivision of the business of electricity supply by entrusting it to the hands of municipal authorities, each restricted to its own communal area. The most notable example of individualism in electricity supply in this country is in the north-eastern counties, where one large organisation has grown up, with the result that a "cheap and abundant" supply of electricity has for many years been at the service of the public.

Elsewhere, as Mr. Hodges states, co-operation is necessary under the existing conditions, in order that a similar end may be attained—namely, the organisation of electricity supply under one authority controlling a large area. In other words, we have to make the best of a bad job, the result of misguided Governmental action in the past.

Mr. Hodges looks to the liberal use of electrical power for our industrial salvation, and here he is following in the steps of the Board of Trade Committees whose reports led to the appointment of the Electricity Commissioners; he advocates high wages and large output with the aid of power. Employers have not the slightest objection to high wages—provided that the large output is forthcoming. But will the trade unions permit their members to "co-operate" in this way?

The fact is that whilst Mr. Hodges's aims are altogether praiseworthy, he is not fully informed as to the facts; he does not realise that it is in the administrative aspect only, and not in the technical aspect, that electricity supply is behindhand in this country, nor has he grasped the fundamental differences between the conditions here and on the North American Continent. However, we cordially welcome his sincere interest in the subject of electricity supply, and are confident that he will do his utmost to hasten its progress.

The London Transport Strike.

On Saturday last, tramway and omnibus traffic in London, with the exception of the smaller omnibus enterprises improperly known as "pirates," came to a complete standstill; the tramwaymen are demanding an advance of 8s. a week, and the omnibus staffs are supporting them. It is well known that the tramways, both municipal and company, were already running at a loss, and Lord Ashfield has stated that the omnibus and railway services are in a similar plight, whilst any increase in fares would probably result in diminished revenue. In view of the fact that there is no surplus revenue in the business, the strike appears to us to be very ill-advised, and is likely to result in serious loss to the employés as well as the employers—and, of course, the public.

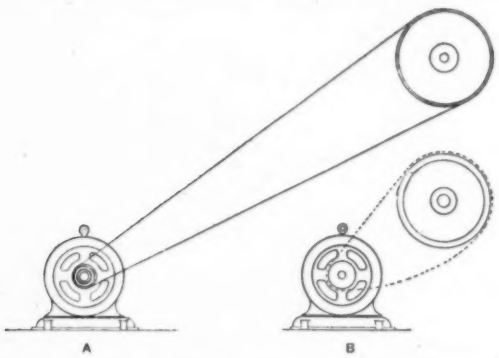
Lord Ashfield informed the Court that in his opinion the only remedy for an impossible situation was the complete co-ordination of all the transport facilities of the Metropolis under a single directing authority—a plan which has repeatedly been recommended by Royal Commissions, and has always been supported by this journal. There can be no question but that the number of omnibuses on the streets when the strike commenced was excessive, and that the traffic congestion which had become so acute during recent months was largely due to this cause, which also adversely affected both tramways and railways by intense competition.

The Court of Inquiry, which sat during the week-end, on Monday issued an interim report attributing the financial difficulties of the tramways to excessive omnibus competition and to their heavy statutory burdens, and recommending immediate legislation to place the passenger traffic of the Metropolitan area under some co-ordinating control, and it was reported that the London Traffic Bill would be introduced in the House of Commons on Tuesday. In the meantime the millions of passengers who daily used the vehicles are suffering very great inconvenience and hardship, though they have no voice in the matter at all.

The Efficiency of Chains as a Power Transmitting Agent.

By HARTLAND SEYMOUR.

A frequent source of waste in industrial plant of every type is the method of transmitting power. In all works where the power used does not figure so largely as it would in, say, a machine shop, too little attention is given to its distribution. Yet here is a field wherein every little economy counts. It has been my privilege not only to design, but also to study other engineers' designs of power transmission systems in England and abroad, and I cannot help being struck by a general lack of proper study of the elements making up an economical



A. Belt drive.—Efficiency secured by long centre distance, and, in absence of proper treatment, considerable belt tension, with consequent pressure on bearings.
B. Chain gearing.—Slip eliminated, space economised and reduced pressure on bearings.

Fig. 1.

and efficient power transmission system. I must at once confess to a very strong preference for the individual drive, *i.e.*, where a group of machinery or a single machine is operated by an individual motor.

In many plants the power generating station has been a model of skilled and thoughtful design; in fact, the engineer in charge has reached as high a degree of power generating efficiency as could be expected. Unfortunately he often leaves it there, and the economies he has effected in his generating plant are often dissipated by a thoughtless and wasteful power transmission system.

I am convinced that many plants in this country would save considerably if they would devote more study to the modern chain as a means of power transmission. There are, naturally, very many instances where a belt or a gear drive is superior and where a chain would be quite out of place. It is not necessary to enumerate these, as this article is primarily concerned with the chain as a transmitting agent.

In general, the advantages of the chain drive may be summed up under these heads:

(1) The efficiency of a well-designed chain drive is as much as 99.6 per cent. under ideal conditions. Even under ordinary commercial conditions the efficiency can be maintained at over 90 per cent. This efficiency is not appreciably diminished throughout the life of the drive on account of the fact that as a chain wears, it mounts the wheel teeth and adapts itself to a correspondingly greater and correct pitch circle.

(2) A positive drive is secured, allowing no slip, giving definite ratios, and increased and more regular production.

(3) Space required for a good drive is small, especially when compared with belts and ropes. The centres can be such that the wheels just clear.

(4) Smoothness and regularity of turning is very marked. This is due to the distribution of the load over a large number of teeth. Only a small proportion of the pull is ever taken by one tooth, and even this is gradually applied.

(5) Elasticity is secured in a great degree by the sag, the oil film in the chain joints, elasticity of material, and the form of the inverted tooth link.

(6) Flexibility of chains is much greater than that of heavy belts and no effort is spent in bending.

(7) Reliability is a special feature. To ensure a reasonable life the amount of bearing surface is always such as to give a factor of safety that entirely eliminates the question of chain breakage.

(8) No initial tension is required to secure adhesion to pulleys, this minimises the total pull on the shafts.

(9) Small obstruction to light.

(10) Erection is simple, as microscopic accuracy of alignment is not required and the centres can be varied over a wide range.

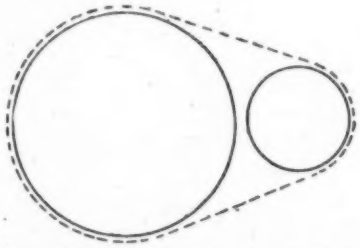
(11) Noise is slight, especially compared with ordinary gears.

(12) Heat and damp, within reasonable limits, have no effect.

(13) No electrical discharge effect as with some belts.

(14) Air disturbance not appreciable and totally absent when enclosed.

The types of chain more generally in use for transmitting power are two (*a*) roller chain and (*b*) inverted tooth-type chain. Each type is suited for work of a specific character, largely decided by the speeds at which the chain has to run, and the best results can only be obtained when a chain is employed within the limits of work for which it is designed.



When centre distances are too short for belts, chain gearing has a maintained efficiency against decreasing efficiency of gears.

Fig. 2.

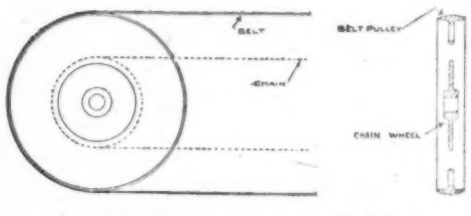


Diagram of chain and belt drives required for the same conditions of horse-power, speed, etc., showing amount of space saved.

Fig. 3.

The roller chain consists of inner and outer link elements, the former composed of two plates, two bushes and two rollers, the latter of two plates and two shouldered rivets. The sizes and shapes of the component parts are carefully worked out in relation to each other, so that as regards breaking load and wearing area the chain is perfectly balanced. The material from which component parts are manufactured is carefully chosen to obtain the maximum breaking loads with maximum wearing area and quality of surface hardness.

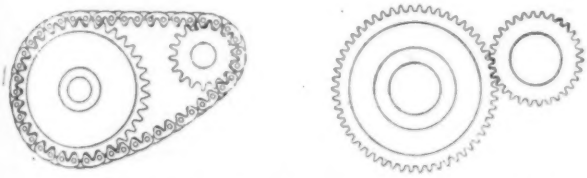
The plates form the connections and housings for the wearing components of the chain, and their form and dimensions are designed so that at the pierced portion of the plates their breaking load is in proportion to that of the rivets.

The life of a chain is dependent on the area and surface condition of the rivet, which also determines the strength of the chain. The selection of chain for specific work is based on the wearing area and bearing pressure.

The bushes are fitted into the plates of the inner link, their internal surface forming the bearing for the full length of the barrel of the rivet and their external surface the bearing for the rollers.

The rollers are components of the inner link, mounted on the bush on which they are free to revolve. Their movement reduces friction and wear between the chain and wheels which would otherwise occur when the chain is moving on to or off the wheel teeth.

The inverted tooth-type chains are made up of a series of flat plates with angular projections, which, ground to angles of 60 deg., and in some pitches of chain 75 deg.,



Multi-tooth engagement of chain on chain wheels, giving smooth, even, turning; efficiency not decreased by wear. Limited tooth engagement of gear wheels with rapid wear and decreasing efficiency.

Fig. 4.

form the driving faces of the chain. These plates are fitted with hardened steel bushes in the pierced holes, and assembled on hardened steel rivets.

The plates are designed so that at their pierced portion they have a breaking load relative to that of the rivet, while providing the greatest possible diameter for the bush which forms the bearing surface for the rivet.

The rivets, as in the case of the roller chain, take the load on the chain; they are, therefore, of the largest diameter possible relative to the breaking load of the bushed plates in which they work.

The principle of the inverted tooth-type chain drive is that of a tooth-to-tooth engagement, the teeth of the chain engaging the wheel teeth over a considerable proportion of the wheel diameter.

The action of the chain when engaging or leaving the wheel teeth is shown in fig. 5. From this it will be seen

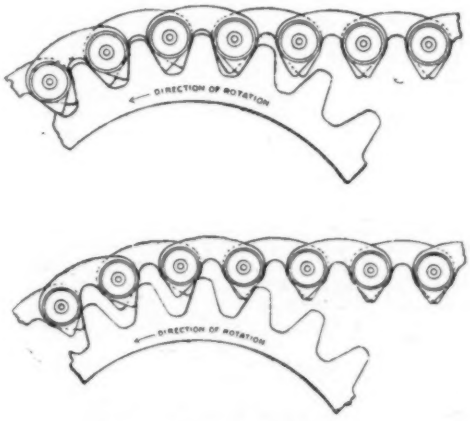


Fig. 5.—Action of Chain.

that there is no sliding action on the tooth faces on entering, during engagements, or on leaving the wheel. When new, the chain fits the wheel as shown in the first diagram, but as wear takes place it moves to a higher point on the wheel tooth, thereby adjusting itself to extension of pitch due to wear. The chain thus maintains its high efficiency of 98 per cent. throughout practically its whole life.

The h.p. to be transmitted and the velocity of the chain are the factors which establish the load or pull on the chain due to the driving load. In addition, there is the load due to centrifugal force and the catenary load. The sum of these three gives the total load or pull on the chain, which must possess a rivet wearing area adequate to withstand the load without undue or rapid wear.

In drives where the chain is run at a high speed, efficient lubrication is most important, and the pinion (or smaller wheel) should not have a small number of teeth, or else the movement which takes place between bush and rivet when the chain is running on to or off the pinion will be large, and considerable wear in the chain joints may result. Additionally, the impact between the chain and the teeth of the wheels is very considerable if the speed is high and the number of teeth in the wheels is small.

The load due to centrifugal force becomes a factor to be allowed for at chain speeds of 1,000 ft. per minute and upwards, thus making it desirable not to use an unduly heavy chain at high speeds. The catenary load is determined very largely by the square of the horizontal span of the chain; it is, therefore, a serious consideration in drives with a long centre distance, or where chains are run taut.

The margin of difference between the working load and the breaking load of a chain (which is the safety factor) may seem excessive. The breaking load of a chain is governed by the diameter of the rivet, but the wearing areas are dependent on the diameter and length of the rivet.

Chain drives should preferably be arranged horizontal or inclined not more than 60 deg., when the large wheel is uppermost in the drive, and not more than 45 deg. when the pinion is uppermost. The angles mentioned are those included by a horizontal line and the line of the driving side of the chain. Shafts must be parallel and truly horizontal. A vertical arrangement of shafts should be avoided if possible as such drives call for special provision in adjustment.

Wherever possible, some means should be provided for the adjustment of shaft centres, so that the slack in a worn chain may be taken up. A greater working life will be obtained if such provision is made. In the case of drives from electric motors, this can be done by mounting the motor on slide rails, or on a number of slotted plate washers. The amount of the adjustment should not be less than 1½ times the pitch of the chain. Where adjustment cannot be provided in the case of a horizontal or inclined drive, the chain may be allowed to run until the slack is sufficient to allow the removal of a link.

In the case of a horizontal drive, where the bottom side of the chain is the tight or driving side, provision should also be made for adjustment either by means of alteration in shaft centre distances or a jockey wheel engaging the slack side of the chain to keep the two portions of the chain from contact. By using chain wheels of large diameter, relative to centre distance, it is frequently possible to dispense with a jockey wheel in this class of drive.

If a vertical or substantially vertical arrangement of drive cannot be avoided, the centre distance should preferably be not greater than the normal minimum, with the larger wheel uppermost if possible. Some arrangement is needed to regulate the meshing of the chain with the lower wheel, preferably by adjusting the shaft centres or by means of a jockey wheel with accurately machine-cut teeth engaging with the slack side of the chain and mounted on an adjustable stud. With inverted tooth-type chains the jockey wheel must engage with the inner or working face of the chain.

A chain works best when running with the tight or driving side uppermost. Consequently, where a choice is possible the direction of rotation should be so arranged.

Chain drives can be successfully installed where the centre distance is so short that the tops of the teeth of the two wheels only just clear. Such an arrangement should not be adopted unless some specific gain will com-

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pensate for loss of durability, as the length of chain over which wear will be distributed is reduced to a minimum. In such cases it is advisable, where space allows, to fit a chain with a greater rivet-wearing area than would be chosen if the centre distance was normal.

Drives with greater centre distances than the normal maximum are a matter for special consideration with all the conditions of the drive taken into account, as the weight of the chain between the shafts may considerably increase the load on the rivet.

The size of the wheels, relative to the drive, is as important as the size of the chain. If the wheels are small the movement of the bush on the rivet is proportionately large, and the life of the chain is unduly shortened through increase of friction and wear. When a chain is running each rivet moves in its bush 1/Nth of a revolution (N being the number of teeth in the wheel). Wheels should, therefore, have the greatest number of teeth that conditions will allow, thus keeping down the movement referred to, reducing loss of energy through friction, and conserving the life of both the chain and wheels.

Pinions should, if permissible, have an odd number of teeth, as this will give uniform wear on wheels and chain:

Number of teeth in wheels.	Roller chain.	Inverted tooth type.
Desirable minimum	17	19
,, maximum	120	120

This applies only to inverted tooth chains with a profile based on a 60 deg. link face angle.

For chains with a profile based on a 75 deg. link face angle, the maximum number of teeth in the wheel is 63.

In all cases where there is a substantial amount of end play on either shaft, provision must be made to allow the chain to move laterally. This is a vital matter, particularly in the case of inverted tooth-type chain drives.

The amount of end play permissible varies according to pitch and width of chain, size of wheels, and distance between shaft centres, but no hard and fast rule can be laid down. The end play on the armature shaft of an electric motor can usually be reduced to a negligible amount if the makers are notified that this is desirable.

It is impossible to secure satisfactory results from chain gearing which is not properly installed. The shafts on which chain wheels are mounted must be truly horizontal and parallel to each other. Shaft bearings must be rigid and chain wheels should be mounted as near to the bearings as possible.

Chain wheels must be mounted with their teeth in correct alignment, and secured from any subsequent movement along the shaft.

Failure to mount the wheels correctly or to see that they are rigidly fixed when correctly mounted will result in destruction of the chain through its plates fouling the wheel teeth. When this occurs (*a*) the chain plates are rapidly worn away and their strength is reduced; (*b*) the engagement of the wheel teeth on one end only of the roller introduces stresses which may, and frequently do, cause the roller to split and shell off the bush. In fact, the whole chain is subjected to such stress that rapid deterioration is inevitable. In the case of an inverted tooth chain the guide plates will be quickly worn through, and may be forced off the rivets.

It is detrimental to the life of a chain to attempt to run it too tight. When correctly adjusted there should be a slight sag in the chain. The exception to this rule is the case of drives with impulsive or irregular loads, where no provision can be made for dealing with the irregularities. In these cases the chain must be mounted taut and kept so by adjustment.

Lubrication of the working joints is essential for chain gearing. The most efficient form of lubrication is to enclose the drive in a case and pump a constant stream of oil on to the inside faces of the chain from a filter pump. An alternative arrangement is to run the chain through oil. One of the above arrangements is essential when the chain speed exceeds 1,000 f.p.m. Where the pinion is below, and is too small to allow the chain to run through oil, an oil thrower disk of a larger diameter than the pinion may be utilised. For speeds up to 1,000 ft. per minute, a drip feed lubricator may be used, fixed so that the oil drips regularly on to the inner face of the chain. A light or medium machine oil should be used, and one drip pipe provided for every three inches of chain width. A splash guard or case may be necessary for this method of lubrication. Periodic cleaning is of prime importance, and it should be borne in mind that this does not mean merely the removal of external dirt, but also the cleansing of every joint and bearing surface. This should be done at least three or four times a year, and more frequently if the chain is working under dirty or damp conditions. To effect this, the chain should be placed in a bath of paraffin oil for an hour or two; it should then be removed and hung up, thus allowing the paraffin to drain off; these operations should be repeated, using a fresh supply of clean oil.

After the chain has been thoroughly cleaned it should be put into a bath of suitable lubricant (which should be kept melted) for several hours, to allow it to penetrate to all the wearing parts of the chain. For roller chains use tallow or grease of a non-acid character, which will partially solidify when cold; the addition of powdered graphite is an advantage.

For inverted tooth chains use a light or medium machine oil. It is necessary that the wearing surface or joints of a chain be lubricated as often and as efficiently as the bearings of any piece of machinery. By lubrication is not meant the application of oil to the external parts of the chain, but the employment of such means as will ensure the oil reaching the inner wearing surfaces. I have already referred to the necessity for providing cases with oil baths when chains are working under unfavourable conditions, or at high speeds.

Where chains are run at any great speed some oil may be thrown off; and in such a case it is advisable to surround the drive with a light screen or guard.

Periodical examination of chains is advisable to ascertain if correct alignment of the wheels has been maintained; if undue wear is taking place; if adjustment of chain tension is needed; if the chain requires cleaning, and to see if lubrication is being effectively carried out.

Resistivity of Pure Copper.—At a meeting of the Institute of Metals, on March 12th, Mr. W. E. Alkins, M.Sc., presented an account of two short series of experiments carried out with the object of investigating the relationship which exists between the tensile strength of commercially pure copper as it is hardened by wire-drawing and the accompanying increase in its electrical resistivity. Two samples of copper of high purity, from imported wirebars, were used. In the case of each sample a number of test lengths, varying in hardness from thoroughly annealed to hard-drawn (tensile strength from about 16 to about 30 tons per sq. in.) were obtained by varying the method of preparation. The first series was drawn to and tested at 0.050 in., the second at 0.112 in. diameter, and reasons are given for regarding the former as the more accurate. Resistance determinations were made on nominal one-thirtieth of a mile lengths, using a five-dial resistance box; the temperature variation was kept as low as possible during the determinations, and both tensile strength and resistivity values were corrected to standard weight. The results show that the relation between the tensile strength and the percentage increase of the resistivity, as compared with the annealed wire, is reasonably rectilinear when the tensile strength exceeds 20 tons per sq. in., and it is suggested that the resistance (R_T) of any given wire of tensile strength T tons per sq. in. should be taken as:—

$$R_T = R_4 \left(\frac{100 + \frac{T}{10}}{100} \right)$$

where R_4 = the resistance of a similar annealed wire corresponding to the international standard.

Electric Lighting in Barracks.—In the Memorandum issued last week by the Secretary of State for War in connection with the Army Estimates for 1924-25 it is stated that progress in the installation of electric lighting in barracks has been continued. Not only is this proving a great boon to the troops by enhancing their comfort, and in consequence their *morale*, but the replacement of less efficient modes of illumination is resulting in a reduction of the annual charges for lighting. Co-operation with other Government departments is being directed to the economy of public funds by the standardisation of patterns of electric plant and fittings for all Government departments; also by arrangements for one service to undertake the whole supply of electric light and water in areas common to the Army and Air Force.

A Dynamical Model Illustrating an Oscillating Valve Circuit.*

By R. C. CLINKER, M.I.E.E.

A MECHANICAL model representing an analogous electrical action is often of great assistance to the student in his endeavour to understand that action, and to form a mental picture of what takes place. Such models were freely used by Maxwell and Kelvin, as well as, in more recent times, by such teachers as Lodge and Fleming.

The following is a description of a dynamical model constructed by the writer to illustrate the action of a three-electrode valve in maintaining steady oscillation in a circuit having inductance and capacity. The model is of the pulley-and-cord type, and resulted from an

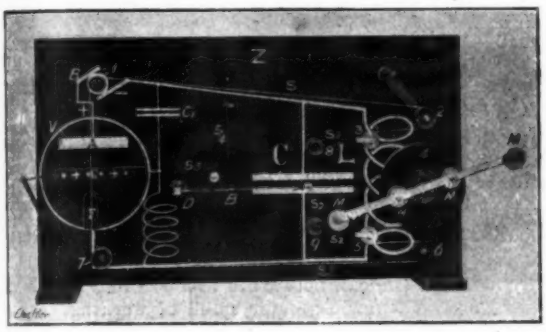


Fig. 1.

attempt to adapt Prof. Jenkin's model (see *Journal* I.E.E., 1922, Vol. 60, p. 939) to represent a valve circuit such as is shown on the baseboard (fig. 1). The three-electrode valve, V, whose filament, grid, and anode are shown by F, G, and A respectively, maintains oscillations in the circuit formed by the main condenser C, and inductance L. The energy is supplied by direct-current source B, placed in the anode circuit. The coupling between anode and grid is wholly electrostatic, and is formed by condenser C_1. Now in this circuit the coil L carries a pulsating current consisting of two components—one a d.c. current from battery B, and the other an a.c. or oscillation current flowing in the circuit LC. To represent the current in L by a motion of a mass, therefore, would require a motion on the whole in one direction. This was not possible with Prof. Jenkin's model, so the writer had recourse to rotational inertia to represent the inductance of coil L. The baseboard Z, on which the parts are mounted, is dead-blacked, and has a diagram of the circuit painted upon it in white lines. A string S passes round pulleys 1, 2, 3, 4, 5, 6 and 7, of which 3 and 5 are "floating," and the others fixed. Another string S_2 joins the centres of the floating pulleys 3 and 5, passing round two other fixed ones, 8 and 9. The centre of string S_2 is clamped to one end of a flat spring B whose other end is rigidly fixed at D. Spring B represents the main condenser C, whilst pulley 4, to which can be fixed masses MM, represents the main inductance L. The five pulleys 3, 4, 5, 8 and 9 are on ball bearings to diminish friction, *i.e.*, to reduce the resistance in the oscillating circuit. The three valve-electrodes are represented in relief by pieces of wood fixed to the baseboard. The grid G has sliding upon it a perforated metal strip which exhibits plus or minus signs when moved to right or left respectively. This motion is caused by that of the condenser spring B, and indicates the polarity of the charge on the grid as controlled by that on the main condenser C. The thread S_3 which communicates the motion represents therefore the "back-coupling" between the main condenser and grid (or plate and grid) shown on the diagram by the small condenser C_1.

The main string S_1 is mottled black and white to represent the moving electrons through the valve and along the wires. It is driven by pulley 1, which is attached to the shaft of a small motor N, fig. 2, mounted behind the baseboard. The motor shaft carries a spur wheel which drives a centrifugal spring-governor O, similar to that used on a gramophone. The usual friction disk P is provided on the governor shaft, and the spring-actuated lever which forces the friction-pad against the disk is controlled by a thread S_4, which passes over sheaves, through the baseboard, and is attached to the condenser spring B. This thread S_4 forms the mechanical coupling which makes the oscillation self-maintaining, and represents the electrical coupling shown by condenser C_1, and also by thread S_3. As the model is intended to show the generation of oscillations, a transmitting aerial may be added, as shown in fig. 3, consisting of a support with a long wire spiral fixed at the top, and attached to spring B at the bottom. The motion of this spiral is a maximum at the bottom, and zero at the top, and represents the aerial current. A strip dips behind an "earth plate" E, and shows, by its movement, the current in the earth wire. The aerial spring is painted white and black to show the aerial current clearly.

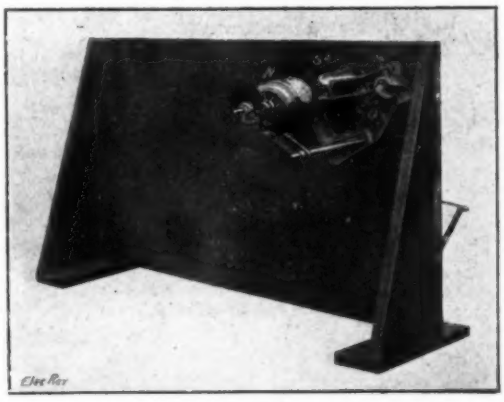


Fig. 2.

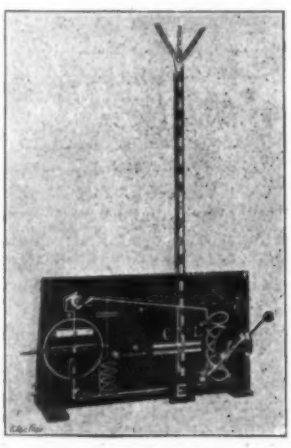


Fig. 3.

In considering the action of the model, suppose B to be held at rest and the motor started. String S_1 moves up through the "valve," and clockwise round the model, while pulley 4 and its weights rotate uniformly. This represents a steady d.c. current through the valve and inductance. Now if B be released, instability is at once introduced, which causes oscillation. This is due to the facts that the displacement of spring B controls the speed

* Patent application No. 29011.

of string s_1 (*i.e.*, the charge on condenser C controls the current through the valve). For, if spring B rises slightly, thread s_4 is slackened, the brake is applied, and the speed of string s_1 through the valve diminishes. Owing, however, to the mass of pulley 4 preventing a sudden diminution of speed of that part of string s_1 between pulleys 3 and 4, pulley 3 is drawn to the right, raising spring B still further. In short, the slightest motion of B in either direction is at once accentuated by the inertia of pulley 4, and hence the unstable condition necessary to the genesis of oscillation is present. Spring B, therefore, rapidly acquires an amplitude of oscillation which is limited by the proximity of pulleys 8 and 9. At the same time the pulley 4 exhibits the combination of a steady clockwise rotation and an oscillatory motion.

A careful inspection of the movements, when the model is working, shows that the main oscillatory movement executed by spring B and pulley 4 is nearly in time-quadrature with the oscillatory component of string s_1. This is in accordance with the electrical case.

The model shows also in a striking manner the high impedance at resonant frequency of a circuit consisting of an inductance and condenser in parallel. If, with the motor inoperative, string s_1 is grasped in the fingers and given a rapid to-and-fro motion, it will be seen that all the motion is taken by spring B (*i.e.*, a high-frequency current passes through the condenser). A low-frequency motion, on the other hand, passes by way of the inductance-pulley 4. If now the frequency is gradually increased to the resonant value, both spring B and pulley 4 exhibit violent oscillation, and a considerable resistance to motion is felt by the hand. Further, the impressed forced is in phase with the motion of the string. This is in accordance with the electrical case, in which the low resistance of a coil and condenser appears as a high resistance, of value L/CR ohms, in the external circuit, *i.e.*, the plate circuit of the valve.

The writer is indebted to the British Thomson-Houston Co. for laboratory facilities used in developing the model. It is manufactured under licence by the Loughborough College, and one will be exhibited on the B.T.-H. stand at the British Empire Exhibition.

Electric Drive in Ports and Harbours.

By W. A. PERRY.

Nowadays the heavy cost of labour and fuel, particularly the former, makes it increasingly important to reduce the other components of "working costs" as much as possible—a vital point in the handling of material, particularly so in ports and harbours in the loading and unloading of ships. The use of electrically-driven machinery would go a long way to alleviate the financial troubles of many harbours and docks, and the special attention of the management and electrical engineers could with advantage be given to this question.

Not only are electrically-driven cranes, hoists, capstans, &c., more easily controlled, but they have very much lower working and maintenance costs. The great ease of control also reduces the cost per ton of material shifted, as it reduces the time of the cycle of operations. It will also attract shipping to the port by being able to give the ship a quicker "turn-round." The installation of electrically-driven machinery in ports and docks would be considered by the management under the following headings:—

(1) The complete equipment of a new quay or wharf.
(2) The installation of separate units (cranes, hoists, &c.) intermixed with existing steam or hydraulic plant.
(3) The conversion of existing machinery from steam, &c., to the electric drive.

The first class presents no difficult points; practically all ports are near to large power stations, whence electricity can be obtained cheaply. This is far better than attempting to generate it themselves, as they could not approach the figure of a large station, and it falls into line with the Electricity Commissioners' ideal.

After considerable experience, the writer's opinion is that the best, cheapest, most easily handled electrical system, is for the port and dock authorities to purchase electric power at high-pressure and transform it to 400/500 volts, 50 cycles, 3-phase, unless a low-pressure supply is obtainable, but this is not likely to be the case, as the power station is usually some distance from the docks. Where power factor is low, the installation of a static condenser is recommended; it will obviate any extra charge for poor power factor. When installing new cranes, care must be taken that they will suit the work and type of ships with which they have to deal. Such dimensions as radius and height of jib it is important to have correct, as also are the most economical speeds of the various motions. Cranes should always have four motions, *i.e.*, hoisting, luffing, slewing, and travelling. The level-luffing type is not only more economical, both as to first cost and running, but also gives a much greater speed of working.

The most practicable method of laying the mains along the quay side is in earthenware ducts, which should be kept a convenient distance from water or gas mains. A sufficient number of spare ducts should be laid in the first instance to accommodate as many cables as may be required in the future. Each crane or hoist can have its own panel and switch on a switchboard, or the cheaper method of one panel and one main for each group can be employed, being separated at feeder pillars placed in convenient positions.

The only objection to the latter is that a fault on the main will stop a whole group, until repaired, whereas with a separate cable to each crane, &c., only one machine would be put out of action. As the great slogan of power station engineers is "keep the juice on," so it is with dock engineers, and everything must be designed so as to reduce the chance of failure to a minimum and, if a fault should occur, to stop as few machines as possible; that "time is money" is nowhere better illustrated than in the loading and unloading of ships.

The design of plugs for travelling cranes, their placing, and method of connection, want careful consideration to suit local conditions. The somewhat usual practice of straight through plugs off one cable is bad; tee joint boxes should be used with disconnecting links, as, if a plug fails, it can at once be isolated, the crane using another while the faulty one is repaired.

In the second class, considering the installation of one or more cranes, hoists, &c., where steam or hydraulic power is used and no mains are laid, it is best, if possible, to try to re-arrange the cranes so as to bring all the electrically-driven ones on to the same quay or adjoining quays. The writer has proved that it pays even to install one electrically-driven crane with its attendant extra cost for cables, switchboard, plugs, &c., as the saving in running expenses and maintenance more than makes up for the extra first cost. If more than one is installed the cost of cables, &c., is reduced per crane.

Considering class (3), the conversion of existing cranes, &c., some makes of steam cranes lend themselves to this much more readily than others, and the question

of an entirely new crane should be considered if funds will permit. When easily converted, the cost is not great, but care must be taken that the centre of gravity falls well within its prescribed limits (at all loads); an alteration of the weight and/or position of the back balance weight is nearly always necessary. Hydraulic cranes, &c., do not lend themselves to conversion, and it is not recommended, but great economy can be effected by driving the hydraulic pump or pumps by electric motors, replacing the usual steam engine and boilers.

Not only is the cost per actual h.p. used far less, but the stand-by charges are eliminated entirely. This saving, of course, is greater where the load factor is low or variable. Motors are very easily and automatically controlled by limit switches on the hydraulic accumulator, and respond quicker than steam engines. They must be of the slip-ring type, preferably with a cascade winding, thus ensuring uniform torque at the lowest speeds, which gives smooth and easy starting, eliminating any danger of damaging gears or pumps.

Most harbour and dock authorities seem to be shy of the use of electric capstans, thinking they are fragile and liable to failure under rough usage. Such is not the case, and there are several makers who produce a thoroughly watertight and fool-proof electric capstan that will stand rough usage, and give far better satisfaction than the hydraulic capstans which are generally used. The 3-phase, slip-ring motor is particularly suitable for capstan work and if the capstan is permanently in gear, such as those used for opening dock gates, &c., a cascade-wound motor is recommended.

Motors for cranes, hoists, &c., should be totally enclosed, as also should the controller and contactor gear, more especially in ports handling metallic ores, as dust blows in and is very liable to cause trouble.

Besides lower running costs, other advantages of the electrical drive are cleanliness, freedom from smoke and ashes, the latter being a benefit to ship-owners as well as to the locality. With steam and hydraulic cranes there is always leakage of water, which is dirty and unpleasant and may damage traffic going under the crane.

Some Manufacturers' Sales Efforts.

By A. J. SMITH.

THERE is a fascination in the study of modern business methods, and there are few things which can on occasion be more useful to retail traders than careful observation of the sales policy of the various manufacturers with whom they are brought into contact. Let me add that apart from occasional instruction there is also a good deal of amusement to be obtained in surveying the different methods adopted by a maker in presenting the merits of his goods in advertisements, in catalogues, in correspondence, and finally in the general conduct of business.

A catalogue or an advertisement is largely an impersonal affair when compared with a letter, in which we look for promptitude, for a full and painstaking reply to any questions we may have asked, and for a careful presentation of the writer's own message, the whole expressed in language so clear that our mind is pleased by its straightforward simplicity, and our *amour propre* gratified by its polished courtesy. Though it would be difficult for an English writer, suffering from the defects of the national temperament as well as from the limitations which custom has imposed upon our means of expression, to rival for suave courtesy the language of a Spaniard, for instance, who habitually subscribes himself in business communications as "Your affectionate and faithful servant, who kisses your hands" in place of our more frigid "Yours truly"—yet our own language is capable of infinitely better things than the average letter-writer gives us.

Maker's Correspondence.

I find from my own experience that the vast majority of radio manufacturers adopt what I may term the "haughty" manner in replying to any inquiry with which they may be troubled. One of the largest and best-known of British makers whom I had ventured to approach with a request for certain particulars of his productions gave me a four-line reply to my inquiry, enclosing a catalogue and saying that in future I had better communicate with Messrs. "X.Y.Z.," his general distributors for my district. The general impression I gathered from this unfortunate effort was: "You have given me considerable trouble in approaching me direct when you ought to know I am too busy to be troubled with requests of this description, but here is a catalogue, and do not venture to write to me again." Upon receipt of such a letter a sensitive person would no doubt blush to think he had so far transgressed the code of etiquette of the higher radio circles which governs the method of approach to the manufacturer; but, as it happened, there was one particular instrument of this make which rather interested me at the time, and not being unduly sensitive when I want to get information, I took the rebuff in good part and paid a visit to the establishment of these general distributors, knocked at the portal, and entered. Inside I found one of the principals exchanging a desultory conversation with a traveller in the centre of the room, while in a corner two members of the staff were languidly discussing some detail of office routine. One minute, two minutes, three minutes passed without anyone taking the slightest notice of my presence; four minutes passed, and I began to find the atmosphere too chilly to be altogether pleasant; five minutes, and I had to confess myself frozen out, and I decamped. In their methods of business, I conclude that both maker and agent have found a kindred soul. Be it far from me, however, to grumble at the procedure adopted, for it was not a week afterwards when in conversation with a valued customer of my own respecting the merits of an instrument which he had obtained from me, he mentioned that it was a matter of pure luck that he had taken this, for he had originally made up his mind to have a "V . . ." make of instrument, and had visited their agents Messrs. "X.Y.Z." to buy it, but after standing in their place for what seemed like several ages without anyone paying the slightest attention to him, he had walked out and come to my place. What the writers themselves designate as "brevity," and what the recipients usually stigmatise as "curtness," is the rule in selling communications from nine out of ten makers in dealing with an inquiry, and particularly is this the case with the better-known makers, most firms being content to deal with an inquiry in four or five lines. To me there is in all these communications a perfectly startling absence of all the arts of argument or persuasion. It may be objected that probably the manufacturers were simply inundated with orders, and that they found it impossible to give adequate attention to inquiries, but most of the instances I have in mind came under my notice during the summer and autumn, when there was anything but a "boom" in trade. Though sales arguments are generally noteworthy by their absence, I was struck by one used by one large maker whose name (so

he stated in his catalogue) was known all over the world. My inquiry was acknowledged and a catalogue enclosed, and referring to certain instruments listed, he added that these "have been tested against most of the best-known makes, and I am convinced that they are the best on the market." As I was not informed by whom the instruments had been tested, nor under what conditions, nor with what precise results, and as I have yet to come across the maker who is not convinced that his own instrument is the best on the market, I am afraid that these statements did not produce quite the impression which was intended; but it does strike one as strange that a more satisfactory argument could not be discovered to attract a potential buyer's attention in the first communication. Yet the industry is not altogether without its effusive scribes, its epistle writers of the fluency (if not precisely of the style) of a Charles Lamb. The lengthy communications, however, are few in number, and they usually come from the "lesser lights" of the industry. A specimen which I have before me tells me of the immense demand which the writer is experiencing, dilates unmercifully upon the efficiency of his instruments (though without giving any details), the wonderful results obtained (again without any details), their splendid workmanship, followed by a highly eulogistic description of almost every component employed in the receiver, the whole being unaccompanied by a single reference to any outside testimony as to its capabilities. There was a flavour of the "mail order" communication about this epistle which made me turn quickly to the end to see if there was any kind inquiry as to the health of "the wife and children" in the manner so beloved of our mail-order salesmen!

The Testimonial.

Generally, I think the radio manufacturer has disregarded the pulling power of the independent test, and the great value attaching to testimony from independent users—with the exception of one particular firm of makers, who seem to conduct most of their sales upon the basis of the claims made by their customers in the really remarkable volume of letters which they are able to bring forward, rather than upon any claims which they make as manufacturers. I have often wondered how far this general disregard is due to the absence of independent reports, and how far it is due merely to lack of appreciation of such testimony. If it is the latter I cannot help thinking that it is a great mistake to assume that the testimonial is played out as a selling force. Whatever may be the case in other industries, I know that I, personally, read and study every report of test that I come across, in the endeavour to discover whether my own results can be improved upon. Particularly am I interested in results obtained in my own district. So by all means let manufacturers give us as much independent evidence as possible of what their sets will do; it should be possible to marshal such evidence without working upon the lines of a patent medicine advertisement.

Catalogues.

If the radio industry is a great and growing one, which is what we are led to believe, then nine-tenths of the catalogues which are issued certainly belie it. Most of them would give the casual reader the impression of an industry born before its time, and dragging through a puny and sickly infancy. The greater portion of the printed matter I receive consists of badly printed sheets and folders, of all sizes and shapes, which it is impossible to file properly. A beginning was made in the early days of radio by a firm of American extraction with an excellent little handbook, followed by one or two others of a similar shape and size, but, generally speaking, manufacturers have now dropped back upon cheap folders and loose leaflets. When one thinks of what the gramophone industry would do with many of the works which are now rendered available to the public by the British Broadcasting Co. and modern receiving instruments, one realises more fully how lamentably the radio trade has failed to make adequate use of the material it has ready to hand for interesting the public. Then there is legitimate cause for complaint about the manner in which the capabilities of instruments are described in many publications. I constantly pick up leaflets stating that such and such an instrument is a "long-range set," but as to precisely what this term means I am left in the dark. I have before me as I write a folder describing a two-valve set, which "will give a range of all the broadcasting stations at present working," no mention being made of its wave-length range. As a trader with a little knowledge of the subject, a statement like this does not mislead me because I know that this particular instrument if used in the centre of a broadcasting town will only receive from the local station until the latter shuts down; but I can readily imagine cases where this leaflet in the hands of a totally inexperienced buyer might lead to some unpleasant results for me or for the maker, if the buyer on the strength of this statement expected to receive all the British stations irrespective of local transmission, American broadcasting, and (say) the principal western European broadcasting! I venture to suggest to manufacturers that the more precise they make their catalogue particulars, the more likely is the distribution of the catalogue to bring in business. Omissions and half-truths of the type I have mentioned merely drive away business by creating a feeling of distrust. Most catalogues and price lists are strangely reticent upon the question of carriage and packing. I notice that in the catalogue of one large firm they are careful to inform me almost at the foot of every page that I shall have to pay for an instrument at the price which may be ruling at the date delivery is given, and not the price at which I order, but strangely enough they fail to state whether it is I or they who will have to pay for packing and carriage.

Continental Methods.

It is only fair to say, however, that British manufacturers are not the only offenders in this respect, for I am constantly receiving offers from various Continental makers quoting me for goods in foreign currencies, for delivery at the maker's works at Paris, Lyons, Vienna, &c., as the case may be. On one or two occasions, out of curiosity, I have written to ask for information as to the approximate cost of delivery of certain quantities through to my address, but I never succeed in getting the information, in spite of the fact that in one case I knew that the maker must have the information readily available as he had made a delivery to another trader in the same town not a fortnight before! Such instances as this seriously weaken one's belief in the fable so assiduously fostered by our sensational Press that we are the most unbusinesslike people who ever set out to try to do an export trade. Some of our Continental neighbours evidently have also a little to learn in this direction.

Of actual business in radio with a foreign manufacturer, I can only claim to have had one experience, which was with a French manufacturer of telephones, whose manager called upon me one day with an excellent sample, and a day or two afterwards delivered to me a quantity which I had ordered, and took away the cash. Though the sample pair was so good, I had trouble with about 15 per cent. of the others, on which I had to make allowances, exchanges, and what not, to smooth matters over. The preliminary letter that I wrote to the makers at Paris, asking what they would do in the matter, was politely ignored, doubtless because it was written in English, but later letters in French, addressed both to the firm, and to the managing director, &c., have all shared the same fate, though the same firm with a touching faith in the shortness of the average man's memory bombards me periodically with letters written in French offering me telephones quoted in francs, and delivery to be taken at its works. There are few makers in this country who would not in such a case have replied to a complaint, even if it were only to disclaim responsibility; and it is this unfortunate experience which has persuaded me to adopt the advice, which appears on most advertisements now, to "**Buy British goods only.**"

Correspondence.

Correspondents should forward their communications at the earliest possible moment. *No letter can be published unless we have the writer's name and address in our possession.*

A Potential Problem.

As the ring is circular and the field is uniform, every small section of the ring of the same length has the same e.m.f. induced in it. Every section has also the same resistance.

It follows, therefore, that at every instant the same current flows in each section. Consequently, at no point is there any accumulation of electricity and, therefore, there is no difference in the electrostatic charge of any section. There can thus be no difference of potential.

A difference of potential is only produced (neglecting the effect of other charged bodies in the neighbourhood) when electricity accumulates. If a length of wire is connected between the terminals of a battery, it is only after a period that the current is the same in all parts of the conductor. At first the amount of electricity which enters any small section is greater than the amount which leaves, the surplus accumulating and charging the section electrostatically to a certain potential. This potential is different for different sections, falling uniformly along the resistance.

The differences of potential of different parts of such a resistance are thus due to accumulations of electricity. This always occurs when the e.m.f. introduced into a circuit is not symmetrically distributed round the circuit, but localised in one portion (in this case inside the battery).

R. H. Nisbet.

Longfield, Kent.
March 17th, 1924.

Your correspondent "F. A. G.," in the current issue, expresses in academic form what must have puzzled many who have studied the theory of dynamo electric machines. It is not strictly correct to assume that a flow of current causes a drop of potential; it would be better to state that the drop of potential, or rather a potential difference (between two points of a conductor) causes the flow of current. When it is expressed in this way one is not so liable to lose sight of the fact that a current can be caused to flow by other means than by a difference of potential.

It is true that a flow of current causes a drop in potential, *when a p.d. is what gives rise to the current.*

A similar example to "F. A. G.'s" may be taken from practice. In a d.c. generator, the positive brush is at a higher potential than the negative brush, or a current would not flow in an external circuit. How, then, does current get from the negative brush to the positive brush inside the armature? The answer is, in simple terms, that it is *forced* to do so by reason of the changing magnetic flux according to the known laws of induction.

It is safe to assume, therefore, that there will be no p.d. anywhere in "F. A. G.'s" ring, and that the current is being sent round the ring by other means, *viz.*, by electromagnetic induction. Were the ring cut at some point so that current could not flow, then potential would "pile up" at one side of the cut and the conditions would be the same as in a dynamo on open circuit.

C. H. Clarke.

Snaresbrook.
March 19th, 1924.

The problem suggested by "F. A. G." is a very interesting one, as it apparently cannot be answered by making use of conventional electrical engineering units.

To avoid the complications of alternating fluxes and currents, let us suppose that a magnetic field of uniform intensity is cutting the ring from the inside to the outside (this is really what the alternating flux is doing at a certain instant). The cutting of the conductor by this flux produces an e.m.f. round the closed circuit.

Now there is a distinction between an e.m.f. and a potential difference, and I think that the question would be best answered by an attempt to explain these terms.

Take the case of a cell—we understand that due to chemical action there is an e.m.f. in the cell—that is, an internal force which under certain conditions would cause a flow of current through a circuit composed of an external conductor and the internal circuit of the cell itself. If we know the resistance of the external conductor and the current flowing, we can find the potential difference betwen the terminals of the cell:—

$$PD_1 = C_1 \times R_1.$$

Suppose we could decrease the resistance of this external conductor until it was infinitely small—we should then have a circuit with a current flowing through (the value of the current depending upon the internal resistance of the cell) and we should find that there was an infinitely small p.d. between the terminals:—

$$PD_2 = C_2 \times R_2 = 0.$$

So that here we have a conductor carrying a current and having no potential difference; it is the e.m.f. of the cell which is producing the flow of current, and it does not need to be evidenced by a p.d.

After all, when we measure the p.d. of a cell by applying a voltmeter to the terminals, we are setting up our own p.d. by establishing a circuit of known resistance through which will flow the current due to the e.m.f. of the cell. Even in the case of a static voltmeter, we establish the conditions for producing a p.d.

If now, in a circuit as suggested in the query, that is, a copper ring of uniform cross section, we can imagine an internal force (e.m.f.) which produces a current flowing round the ring without a difference of potential between any two points in the conductor, then the question will be answered. As a matter of fact the whole structure of electrical calculations is built up of conventions which are quite legitimate, but which in certain cases do not seem to be consistent. If we could build up our equations or theories fundamentally from the electronic theory, we should, I think, have no seeming paradoxes.

R. Leach.

London, *March 17th*, 1924.

[This question has aroused much interest, and we have received many replies, of which we print a selection. As Mr. Leach suggests, the best course is to consider the electrons; then any difficulty that may seem to exist (though we do not admit that it exists) disappears at once. An electron is apparently not affected by a stationary magnetic field, but when it is immersed in a moving magnetic field it is acted upon by a force at right angles to the direction of the field and to the direction of motion of the field; that force is "electromotive force." If the electron is free to move, it moves, and a moving electron is an "electric current." (Incidentally, it takes 6.36 million million million electrons passing a given point per second to make a current of one ampere). If all the moving electrons in the uniform ring postulated by "F. A. G." are equally impelled by the moving magnetic field and are equally free to move, there can be no difference of potential, which, as stated by Mr. Nisbet, would imply a piling-up of electrons at one place more than another. Thus an e.m.f. can exist and produce a current without producing a p.d.

A current can also flow without an electromotive force existing, as Prof. Onnes has shown. But to attain that result the conductor must be without resistance, a condition which occurs when it is cooled down to the absolute zero of temperature.

The physical basis of electrical phenomena has been admirably dealt with by Prof. W. M. Thornton from the standpoint of the electron in his little book, "First Principles of the Electrical Transmission of Energy" (Pitman).—EDS. ELEC. REV.]

Electricity Supply at Shanghai.

My attention has been drawn to an article headed: "The Electrical Industry in China," appearing on page 74 of your issue of January 11th, 1924, from which it would appear that the source of your information is not entirely accurate.

It is stated that:

"In Shanghai there are nineteen electric light and power companies, mainly Chinese, with a total capacity of some 25,000 kilowatts. . . . The number of lamps connected, about one million, is less than in Canton. . . ."

So far as my knowledge goes, there are but four electricity supply undertakings operating within the Shanghai area, of which two are under foreign administration, and two are operated by Chinese. Supply is derived in a large measure from the Shanghai municipal undertaking so far as three of these undertakings are concerned, and the total capacity of the plants is of the order of 130,000 kilowatts.

Whilst I have not available information concerning the total equivalent lamps connected, I would say that this undertaking supplies an equivalent connection of 4,000,000 30-watt lamps.

Trusting that this information will be of value to you.

T. H. U. Aldridge.
Engineer-in-Chief and Manager,
Shanghai Municipal Electricity Department.

Shanghai, *February 29th*, 1924.

Gas, in the Light of Experience.

In the Notes which appeared in the issue of the ELECTRICAL REVIEW dated February 22nd, dealing with the supply of electricity by gas undertakings, reference was made to the remarks of Mr. Reginald Clarry, M.P. He suggested that since he had left the gas industry he had been able to get the gas perspective from another point of view. This reminded me of my own recent personal experience; for after living from my boyhood's days in houses which were electrically lighted, I had perforce to return to gas when I took up farming after the war; in fact, I had to be thankful not to have to depend upon oil lamps.

Right from the outset my cows and chickens had electric light, but there were various difficulties in conveying it to my residence. Among these were an intervening property, and the prospective development of some water power I had

on the farm. Thus for several years I have been having real experience of gas, and in the words of the poet, I find it to be really and truly the limit.

As you are aware, for many years, in connection with various electricity supply undertakings, I made it my business to investigate the superior advantages of electricity over gas, with the ulterior object of improving the load factor of the electricity undertakings with which I was associated. My recent experience with gas has fully demonstrated to me that I was always too modest in eulogising the advantages of electricity. Just before the war, my private house was equipped with every conceivable electrical accessory with which to facilitate housework and add to the comfort of the occupants, from Synchronome electric clocks to electric Mary-Ann motors; hence the effect of the return to gas can better be imagined than described.

In the past I have been associated with combined gas and electrical undertakings in America, which operate along the lines suggested by Mr. Clarry, and as indicated by him the combination works very well, though the respective managers of the gas and electricity departments are rather apt to go for each other. Definite rules had to be set out as to the class of business that each was to specialise in, and also the respective areas that they were to develop more particularly. Even then the general policy adopted was not to extend the gas mains, but where they existed, to push the sale of gas cookers. The main reason for pushing the sale of gas cookers was the American standard practice of using a multiplicity of small transformers for town lighting distribution. For many years America has been behind European practice in the installation of electric heaters and cookers on account of the small sizes of transformers that were installed, as the outcome of the experience of electric lighting only. Nowadays, this is changed, and the sale of electric cookers and auxiliary electric heaters (notwithstanding that every house has central heating) is enormous.

R. Borlase Matthews,
Wh.Ex., A.M.Inst.C.E., M.I.E.E.

East Grinstead.

Wiring in a Corrosive Atmosphere.

Electric wiring in hazardous atmospheres detailed by your correspondent "H. A. D." presents insidious, but nevertheless interesting, problems. Experience shows that each condition must be treated separately, and there is no one method of wiring which will overcome or withstand all conditions.

Heavy gauge steel conduit wiring is far from suitable if only because the conduits rust up solid, and in a very short time it is impossible to open them out. Not only this, but it is more difficult than is apparent to make a conduit system absolutely watertight.

C.T.S. cables meet the conditions to a certain extent, but it is important that the cables are run properly. The running of this type of cable on porcelain cleats is to be discouraged, as it is now well-known that the portion of the cab-tire sheath which is under pressure at the cleat becomes hard and brittle and, as a consequence, opens, even showing the conductor, in a short space of time. By far the best method of running C.T.S. cables is by passing the cables round porcelain bobbins.

Metal-sheathed cables are suitable for the conditions under consideration, and they can be covered with bitumastic, or if in hot and moist atmospheres with other, compounds where this is thought necessary. There is often an objection put forward to metal-sheathed cables because of the metal sheath pitting, but this is overcome by efficient bonding.

The main problems in all systems are the accommodation of the cable ends and facilities for replacing any part of the installation. For C.T.S. cables heavy cast-iron boxes having stuffing glands are by far the best means of sealing the cables.

With metal-sheathed cables, of course, the connections of the fittings to the sheathing can be wiped, but this does not allow of easy replacement. The sheathing can be screwed and jointed to the box and fittings by means of the screwed gland, as in the "Glo-Clad" and "Sanco Screwed System." The screwed connection to the cable is absolutely watertight, and any fitting or piece of cable can be taken out without interfering with other parts of the installation. A noteworthy feature of the "Sanco Screwed System" is that it is rust proof, the boxes being made of antimonial lead.

For protecting brass, steel, and iron parts, painting with manganese paint is found to give a good protection, and this paint has an advantage of not setting hard and, therefore, does not interfere with the screwing or unscrewing of threaded parts.

F. J. Pearce, A.M.I.E.E.

Sale, *March 22nd*, 1924.

Plumbing Joints.

Referring to Mr. Rogers's remarks in your issue of March 14th with regard to the name and address of manufacturers of "eights" or double-wicked tallow candles, I have made inquiries and find that the firm I had in mind gave up business about a month ago. However, I understand that there is a firm named Hall at Nuneaton who manufacture candles, and if Mr. Rogers wrote to them possibly they could oblige him with some.

Peeping Tom.

March 18th, 1924.

Street Lighting.

By Capt. W. J. LIBERTY, City of London Lighting Superintendent.

(*Abstract of paper read before the* Institution of Public Lighting Engineers and Superintendents.)

Public street lighting is a wide term, being bound up with many factors such as transport, traffic control, safety, &c., but "bad" lighting is quite apparent and badly placed, spaced, and maintained lights are common, the reason being that it is no particular person's duty to look after this important work. It is often entrusted to an official already overburdened with multifarious duties, who has perforce to relegate the work to others, whilst cleansing, sanitation, &c., have each their respective properly qualified officer—all of which militates against good lighting.

For main roads of 100 ft. in width, used for through traffic, I would suggest 25 ft. 6 in. standards, about 175 ft. apart, down the centre of the roadway.

Thoroughfares 80 ft. wide, with fast through traffic, should be lighted partly by standards on the footway and partly by central road lighting, the refuges guiding traffic and aiding foot passengers. Height of standard should be 13 ft. 6in., the lamps 100 ft. apart, and staggered. This gives generous illumination with a light source of 1,000 candles per unit, but the traffic in the evening demands it.

In roads 50 ft. or 60 ft. wide I suggest central suspension lighting 27 ft. 6 in. above the centre of the roadway, and 150 ft. apart. This would give practically a shadowless roadway in the rush hours. At midnight each other lamp could be extinguished, whilst advantage could be taken of the junction of the thoroughfares to suspend the lamp over the centre, thus diffusing the light down the cross streets, enabling the small lamps to be extinguished for some considerable distance, breaking the difference in the brightness of the main road and the lesser lighting of the smaller streets and abolishing relative darkness. This has been workable in actual practice and experience. The lamps should have raising, lowering and travelling gear to bring them down to the footpath.

In side streets 30 ft. in width, superheated double-burner inverted gas lamps or electric twin-bulb metallic-filament or gasfilled lamps, shaded and staggered 100 ft. apart on brackets 11 ft. or 12 ft. in height, should be used to free the footways, whilst for lanes 15 ft. in width a single superheated gas burner or a 75-candle-power electric metallic-filament bulb in a suitable lantern on brackets spaced at 90 ft. and at a height of 11 ft. from the pavement should be ample.

In courts I would place brackets with one unit lamps irrespective of spacing to cut out all shadows and lurking places.

In large traffic centres high-power gas and electric arc lamps of 3,000 candle-power on columns upon refuges are most suitable.

Chief Constable Bassom, Director of Traffic Services, gives the number of vehicles passing various points between 8 a.m. and 8 p.m. on a corresponding selected day in 1922 and 1923 as under:—

	1922.	1923.
Hyde Park Corner	51,000	56,000
Piccadilly Circus	40,000	41,000
Trafalgar Square	38,000	42,000
Blackfriars Bridge (north side) ...	20,000	29,000

The increase is more marked still over a period of years:—

	1904.	1923.
Hyde Park Corner	29,000	56,000
Piccadilly Circus	27,000	41,000
Trafalgar Square	27,000	42,000

Thus, when, with very little warning, areas like that in front of the Mansion House and the northern end of Blackfriars Bridge are plunged into darkness, whilst the volume of traffic still rolls increasingly on, the need for good artificial lighting is absolute.

Cheapside may seem to be somewhat brilliant and slightly spectacular, but it is the shopping thoroughfare of the City, and half the lamps are extinguished at midnight. The thoroughfare is devoid of glare owing to the prismatic reflector or dioptric lens, thought out by Mr. Peard, of the City of London Electric Lighting Co. It is especially cut to enable all upward and other useless rays to be used in the horizontal direction, so that the street is absolutely shadowless from end to end. Walking down the centre of the roadway a paper can be read, a pin seen on the road surface, and the numbers of the motors travelling at a fast rate at night, when the street is clear, can be read with ease.

"Glare" is still a very controversial subject, and more attention will have to be given to it, especially if "relative darkness" caused by the difference in illumination in main and subsidiary streets is to be put an end to.

Glare can be entirely avoided by screening the light sources so that the eye is not directly exposed to the intrinsic brilliance.

This was found possible in Cheapside in the early days when, with 12½-ampere Oliver arcs of nominally 3,000 candle-power with clear outer globe and a prismatic lens at 15 deg., the value was 3,600 candle-power; but by making the globe opalescent with a frosted band to obscure 15 deg. angles and the dioptric reflector in, the direct rays were brought down to 2,000 candle power, and the disagreeable scintillations that met the eye at this angle vanished, but the illumination in the street did not suffer.

A street-lighting specification cannot be settled by candle-power at the light source, but illumination on the road surface, whether in foot-candles or some other method, will remain a fruitful topic of discussion for the future. The measurement of the light, the classification of the streets, and the illumination basis will form the ground work of such a specification, and will call for much careful thought.

Reviews.

Lighting Circuits and Switches. By TERRELL CROFT. Pp. xii+472; figs. 556. London: McGraw Hill Publishing Co., Ltd. Price 15s. net.

This is a further volume from a versatile and prolific writer, and so far as this country is concerned it can be suggested as being suitable for the advanced specialist only. In the hands of the general electrician it is likely to do more harm than good; such a person would do well to rely rather upon that handy reference book issued by a firm of well-known switch manufacturers.

Throughout the work is necessarily based upon American rules and practice, so that to a British reader there is much that would not be tolerated in a first-class installation in this country. Nevertheless there is a considerable amount of information to be gleaned, and a discriminating person may find in the pages many novel and useful suggestions.

Switch design and construction is very thoroughly dealt with, and the ingenious mechanisms utilised in rotary switch manufacture should be of more than passing interest. Similarly the various switch combinations are worth noting. Underwriters' requirements deal specifically with the American point of view. There appears to be a good deal of padding when one turns attention to circuits; in our opinion, many needless examples are given, so that a careful sifting of the matter becomes necessary. Master or emergency circuits form the subject of the next section, and respecting this we would make like comment. Electrolier switch circuits cover a chapter containing particulars of over-elaborate arrangements, which, though useful perhaps at very rare intervals, tend to confuse the average individual. Interest is aroused in regard to remote-controlled circuits which appear to be highly developed, though we doubt whether great use of such circuits will ever be made on this side; door and time switches are for some reason allocated to this section. After a chapter on theatre circuits, an actual complete specification of the electric wiring of an American theatre is quoted, and we believe that it is in these last pages that the most useful information for the English reader is to be found.

The book contains nearly six hundred most admirable sketches and diagrams illustrating the matters dealt with in the text, and we have seldom seen a work in which so much care and labour has been exercised in this direction. There cannot be any doubt but that the author has dealt with his subject exhaustively, and we recognise that he has produced a practical reference book, but we think he has erred on the side of overloading it.

The Smoke Inspector's Handbook. By H. G. CLINCH, M.R.San.I., M.I.H., with a Foreword by C. BANKS, M.B., B.S.(Lond.), D.P.H.(Sheff.). Pp. xvi+136. Figs. 60. London: H. K. Lewis & Co., Ltd. Price 7s. 6d. net.

This book has been written primarily with the object of assisting Sanitary Inspectors and Public Health Officials to a proper understanding of the methods by which coal is consumed in the boiler furnaces, and as a text-book for those who wish to enter for the examination connected with Smoke Inspectorships.

The fundamental principles involved in the use of such instruments as CO_2 recorders, draught gauges, and thermographs, are explained in a simple and concise manner.

Heat and energy are dealt with in a very elementary way, but an extremely simple and useful formula for calculating approximately the amount of steam required by an engine of a given size is shown, with examples.

Two chapters are devoted to fuel and fuel combustion, and here also the subject is treated in an elementary manner, although probably sufficient information is given for the purpose desired.

Some good advice is given on stokers' work, and the writer states that he is firmly convinced that coal consumers will eventually be forced by economic reasons to burn coal in a more scientific manner than at present in order to prevent the disgraceful waste of fuel that is going on daily. Whether the time will come when all boilers will be fitted with mechanical stokers and equipped with coal elevators is very doubtful, because most engineers are aware of cases where mechanical stokers have been discarded, and hand stoking reverted to; it is also problematic whether it would pay to install mechanical stokers with single or even double boiler plants.

The average stoker has a great deal to learn about the combustion of fuels, and the idea that the only qualification necessary is strength, is, of course, quite wrong; most engineers will agree with the author when he states that stokers should be classified as skilled labourers and that if some method of teaching these men the principles underlying their work were introduced, the return to the employers would be surprising.

The stokers of to-day are in most cases far superior in education to those of a few years back, and as a rule, are only too willing to learn about their work. With encouragement in the shape of good pay a great saving would be made in coal consumption.

Various methods of hand stoking are referred to, and side firing, or right and left firing, is considered by the writer to be the best method, because he claims that greater evaporation can be obtained by that method. Probably some engineers will disagree with this opinion, and consider that sprinkling is superior; that at least is the universal method in marine work.

The chapter on draught covers the question in a very satisfactory manner, and flue gases which are, of course, the best indication of furnace efficiency, are considered; a useful table showing the percentages of heat lost in flue gases with varying volumes of CO_2 is given.

The composition and nature of smoke, the methods of taking observations, and the best methods of avoiding smoke are fully discussed. The object, manufacture, position, and management of economisers take up a chapter, and the most common types of boilers for land purposes are described. The advantages to be obtained from mechanical stoking are gone into, and a number of the most popular mechanical stokers are described in detail. The book finishes with a chapter on the law relating to the emission of smoke, and the power to deal with smoke in England, Wales, and Scotland.

Altogether the book covers the fundamentals of the subject of smoke in a very practical and satisfactory manner, and it can be recommended to those who wish to obtain an elementary text-book free from difficult technical terms.—E.P.

Galvanomagnetic and Thermomagnetic Effects. By L. L. CAMPBELL, Ph.D. Pp. xii+311. Figs. 151. London: Longmans, Green & Co. Price 16s. net.

This monograph is dedicated to Edwin Herbert Hall, and is mainly devoted to the "effect" called by his name. Sir Wm. Thomson (Lord Kelvin) predicted the possibility of a "rotatory power" in a metal in a magnetic field, as long ago as 1851. He had ascertained that a piece of iron in a state of magnetization, possessed different thermo-electric properties in different directions, and thought it might therefore possess rotatory thermo-electric power. Feilitzsch, then Mach, and afterwards Gore, endeavoured to detect such an effect, but failed. Finally, E. H. Hall published an article entitled, "On a New Action of the Magnet on Electric Currents," in which he was seen to have succeeded. The "Hall effect" may be considered to be due to the rotation, by the magnetic field, of the equipotential lines in a plate carrying an electric current. This has opened, in the words of our author, "a vast and fascinating domain, wherein dwell some of the mysteries of matter," and the investigations described in this book will be seen to have cast many illuminating shafts of light on the inter-atomic and intra-atomic action in substances of different kinds. The investigations are proceeding by the activities of numerous workers in many departments of the field, and their results can only be appreciated by careful regard to the details of experiments which are vast both in number and variety: so the book before us is rich in detail. Probably the most useful information that can be given to those who are interested in this line of inquiry is an inventory of its contents, and even this must be a lengthy affair. The first two hundred pages are occupied with the description of galvano-magnetic phenomena, and another sixty pages treat of thermo-magnetic phenomena; the remainder of the book consists of a bibliography embracing 618 publications and an index. In the first part, Chapter I describes the Hall effect; Chapter II, fourteen methods of determining it; and Chapter III, eight variations of the effect. Chapter IV deals with the effect—(i) in compounds, (ii) in alloys, (iii) in dielectrics. In Chapter V are collected some twenty different theories of the Hall effect in solids; in Chapter VI four theories of the Hall effect in electrolytes. Chapfers VII, VIII, and IX treat of the Hall effect in gases, the Corbino effect, and the Ettingshausen effect respectively. Chapter X deals with resistance in the magnetic field, and Chapter XI with galvano-magnetic longitudinal temperature differences. In the second part Chapter XII describes the Vernet effect and its relation to the foregoing effects, and Chapter XIII describes the Righi-Leduc effect and its relation to the others. Chapter XIV treats of thermo-magnetic longitudinal potential difference in metals; Chapter XV of thermal

conductivity in a magnetic field, and Chapter XVI of magnetism and thermo-electric power in metals. And this part ends with an addendum giving Hall's latest theory of his effect. This brief summary may enable the prospective buyer to obtain a general idea of the contents of the book he thinks of acquiring Doubtless he will agree that he is offered full value for his money—good measure pressed down and flowing over.

Developments in Power-Station Design. By Edwin Austin. Pp. xv+271; figs. 239. London: Constable & Co., Ltd. Price 31s. 6d. net.

It is the habit of restaurateurs to re-hash the remnants of meals to make up strange and wonderful dishes which presumably help their profits, and do no harm to diners of adequate digestive power. The book under review seems to have been made up in a somewhat similar manner to that outlined above. It consists of a collection of articles on the various elements which go to make up an electrical power station. These articles, when freshly served up in *The Engineer*, were obviously quite acceptable, but when collected in book form the result is far from satisfactory.

Eighteen chapters deal with the following subjects:—Electricity Supplies; Pulverised Coal Plant; Oil Fuel; Low-Temperature Carbonisation; Waste Heat; Air Heaters; Boilers; Mechanical Stokers; Pneumatic Coal-handling Plant; Protective Gear; Ash-handling Plant; Evaporators; Turbo-generators; Condensing Plant; High-pressure Steam Plant; Instruments; Switchgear; and Transformers and Rectifiers.

The amount of space devoted to these subjects is very variable; for example, Mechanical Stokers are dismissed with three and a-half pages, while Pulverised Coal Plant gets 30 pages. Boilers themselves get only 13 pages. This division of space may, however, be quite in keeping with the developments which have taken place in the apparatus dealt with.

Many of the articles are extremely sketchy, as, for example, those on Instruments, Switchgear, Transformers, and Protective Gear, and are of no value whatever to anyone who is seriously engaged in power-station design. The work of the printers is excellent, and the illustrations—with one exception (fig. 188), which is crude in the extreme—are of a very high standard. The price of the book is 31s. 6d. net, or about ten times the value placed upon it by the reviewer.

Clerk Maxwell's Electromagnetic Theory. By H. A. Lorentz. Pp. 35. London: Cambridge University Press. Price 1s. 6d. net.

This is a pamphlet of some 5,000 words, reproducing the Rede Lecture for 1923. It is mainly devoted to describing the position occupied by Clerk Maxwell's contributions to electrical theory in the historical development of that science. Maxwell's work, as everyone knows, grew up out of Faraday's, and was the completion and generalisation of ideas originated by Faraday; and although there were other people responsible for some mathematical developments and elaborations that ensued, when we refer to those wonderfully simple equations in which the fundamental laws of electromagnetism are embodied, we describe them as "Maxwell's equations," and no name could be more appropriate, though, as the author observes, Maxwell did not put them into the form in which they are now used.

Towards the end of the pamphlet the question is asked: "Will it be possible to maintain these equations?" and the answer is doubtful, for, although with comparatively slight modifications they may be adjusted to comply with the requirements demanded by considerations of "relativity," the "quantum" theory presents features that are in absolute contradiction to these equations. This pamphlet deserves the attention of all those who are interested in the history of what is now called the "new physics."

Business Notes.

Bankruptcy Proceedings.—William Appleyard Beaumont, 44, Warrengate, Wakefield, electrical engineer.—The public examination of this debtor was held recently at the Court House, Wood Street, Wakefield. The statement of affairs showed gross liabilities of £338, of which £236 was expected to rank, and there were assets amounting to £73. Debtor attributed his failure to losses on contracts, lack of capital and a bad debt. It appeared that he started business at Union Square, Wakefield, in March, 1919, in partnership with another, with £66 13s. capital, contributed equally. They did not get sufficient work to support them both, and in consequence debtor paid his partner out for £30, of which £20 was lent him by his mother, and he thereupon continued the business on his own account. In August, 1922, he sold his stock, &c., for £75, of which £25 was paid down. Subsequently the purchaser executed a deed of assignment, to which debtor did not assent, and a bad debt of £50 was made. Since September, 1922, he had opened the shop at his present address with £50 borrowed from his mother. He admitted having attended local race meetings, and having lost money by betting. After further questions the examination was closed.

Robert Stockman Mace, 4, Swanhurst Lane, Kings Heath, Birmingham, late trading as Mace Bros., 8, Washington Street, Birmingham, general brassfounder and manufacturer of wireless goods.—The public examination of this debtor was held on March 19th at the Court House, Corporation Street, Birmingham. The statement of affairs showed a deficiency of £1,306. Debtor attributed his failure to losses made by speculation on the Stock Exchange, bad trade, ill-health, and losses incurred in the manufacture of wireless goods. It appeared that he acquired the business from his brother for £900, paying £350 down, and the balance by instalments. He had speculated in shares for some years, and had lost on certain shares. In December, 1922, he commenced the manufacture of wireless goods, but there was a glut on the market and he sustained a loss. The Official Receiver intimated that a composition of 6s. 8d. in the £ had been accepted by the creditors, and the case was adjourned for the signing of the notes, it being stated that application would then be made to the Court for approval of the composition.

E. L. Harris, electrician, 6, Short Street, Swansea.—First meeting March 29th, at the Official Receiver's offices, Government Buildings, St. Mary Street, Swansea. Public examination April 4th, at the Town Hall, Swansea.

C. Lote, plumber and electrician, 8, Bray Street, Willenhall, Stafford.—First meeting March 28th, at the Official Receiver's office, 30, Lichfield Street, Wolverhampton.

J. E. Elliott & J. M. Elliott (J. E. Elliott & Co.), electrical engineers, 12, Broad Street, Oxford.—Application for discharge to be heard at Carey Street, W.C., April 16th.

J. H. Whitehouse, electrical engineer, 61, Martin Street, Morriston, Swansea.—Last day for proofs for dividend April 5th. Trustee: Mr. H. Rees, official receiver, Government Buildings, St. Mary Street, Swansea.

J. Kaye-Fish, wireless instrument maker, late of Weir Hall, Edmonton.—First and final dividend of 3s. 6½d. in the £, payable at the Official Receiver's office, 29, Russell Square, W.C.

Company Liquidations.—Free Wire Light Co., Ltd.—A meeting of members is called for April 25th, at 384, Salisbury House, E.C., to hear an account of the winding-up from the Liquidator, Mr. C. R. Lee.

New Electra Sign Co., Ltd.—Winding up voluntarily. Liquidator: Mr. R. B. Tyler, 1, Queen Victoria Street, E.C. Meeting of creditors at the Liquidator's offices, March 31st.

Submarine Motor Ship Cleaner Syndicate, Ltd.—Liquidator, Mr. H. E. Burgess, Senior Official Receiver, released March 6th.

The Electrical Co., Ltd.—Liquidator, Mr. H. E. Burgess, Senior Official Receiver, Carey Street, W.C., released March 1st.

Private Arrangements.—John McLaughlin, Edward McLaughlin, and Edward V. Shanagher, trading as Shanagher & McLaughlin, electrical engineers and contractors, 13, Butcher Street, Londonderry.—The creditors interested herein were called together at Derry recently, when a statement of affairs was submitted which disclosed liabilities of £3,331, of which £2,724 was due to sundry creditors, and £606 was due to the bank. The assets consisted of: Sundry debtors, £1,366; estimated profit on unfinished contracts, £78; stock on hand, £983; tools, instruments, and plant, £165 16s., estimated to realise £150; and office furniture and fittings, £164, valued at £150, making total assets of £2,728, from which had to be deducted £183 for preferential claims, leaving net assets of £2,545, or a deficiency of £786. It was reported that the business was commenced in February, 1920, with £300 capital. For the year 1922 a loss of £751 on the trading was shown, while in the following year there was only a small profit. The matter was discussed, and it was decided to adjourn the meeting to enable an amended statement of affairs to be prepared, including the assets of the partners.

The statement of affairs presented at the adjourned meeting held at Belfast showed liabilities of £3,249, made up as follows:—Sundry unsecured creditors, £2,857, and bankers £391. There were also fully-secured creditors for £607, who held security valued at £802, leaving a surplus of £194. The assets totalled £2,827, and consisted of: Sundry debtors, £1,124; stock-in-trade, £897; tools, instruments, and plant, £162; office furniture and fittings, £150; and surplus from security in the hands of fully-secured creditors, £194. After deducting £40 for preferential claims, the net assets amounted to £2,787, or a deficiency of £461. The fully-secured creditors were the London General Insurance Co., Ltd., in respect of an advance on mortgage of £600, and the security they held consisted of the deeds of 13, Butcher Street, valued at £750, and a policy for £1,000 on the life of John McLaughlin, the surrender value of which was stated to be £52. It was stated that from investigations made, it appeared that the deficiency was accounted for by excessive overhead charges and losses

due to falling prices. It was further reported that two of the partners had no separate estates, while the third was not possessed of sufficient assets to meet a liability to the bank.

A suggestion was made that the debtor Shanagher should take over the assets and pay the creditors a composition of 10s. in the £, at 4, 8, and 12 months.

After discussing the position, the creditors intimated that they were agreeable to the debtor Shanagher taking over the assets of the firm and paying a composition of 13s. 4d. in the £ by four equal quarterly instalments, the last three to be secured to the satisfaction of the principal creditors. The following are the principal creditors:—

	£		£
Crompton & Co., Ltd.	714	Falk, Stadelmann, Ltd. ...	72
Crossley Bros., Ltd.	505	Electric Construction Co., Ltd.	46
Drake & Gorham, Ltd. ...	406	Edison Swan Electric Co., Ltd.	46
Sun Electrical Co., Ltd. ...	160	T. & C. Martin	44
British Thomson-Houston Co., Ltd.	124	Siemens Bros. & Co., Ltd. ...	38
General Electric Co., Ltd. ...	118	New Pelapone Engine Co., Ltd.	27
Chloride Electrical Storage Co., Ltd.	114	Siemens & English Electric Lamp Co., Ltd.	25
Walsall Hardware Mfg. Co., Ltd.	96	D.P. Battery Co., Ltd.	25
Petters, Ltd.	82	John McColgan, Ltd.	25
		Johnson & Phillips, Ltd. ...	23
		Pope's Electric Lamp Co., Ltd.	18
		T. McElhenny & Sons	13

THE ASSOCIATED ELECTRIC CO., 21, Waterloo Street, Glasgow.—The creditors interested herein were called together recently at the offices of Messrs. Maclean, Gardner & Aiton, 115, St. Vincent Street, Glasgow, when a statement of affairs was submitted, which showed liabilities of £4,890, of which all but £70 was due to the trade. The assets were estimated to realise £2,590, from which had to be deducted £140 for preferential claims, leaving net assets of £2,449, or a deficiency of £2,441. It was pointed out that the estate showed an apparent dividend of 10s. in the £, subject to the expenses of realisation and administration. It was stated that the concern was carried on by Patrick M. Healy, who started business in 1916 with a capital of £50. At the outset the drawings were £2 a week, but subsequently they were increased, and had been as much as £7 a week. It appeared that during the year ended April 30th, 1918, there was a profit on the business of nearly £400, whilst in the following three years the profits rose continuously, and for the period ended April 30th, 1921, they totalled £865. Since that date losses aggregating £1,874 had been sustained. The principal loss was since May 1st of last year, the business since that date having been carried on at a loss of no less than £1,443. It was pointed out that the debtor had lost a good deal owing to the backward state of the ship-building industry and the heavy fall in the prices of wireless goods after he had laid in a substantial stock. A considerable loss had also been sustained through bad debts. The premises were held at a rental of £295 per annum.

After discussing the position, the creditors decided to confirm the trust deed which had already been executed to Mr. Maclean.

Dissolutions of Partnership.—HARMAL ENGINEERING CO., electrical engineers, 3, Arcade Chambers, St. Mary's Gate, Manchester.—Mr. R. C. Bradley and Mr. W. P. F. Peto have dissolved partnership. Mr. Peto will attend to debts and continue the business.

SMITH & PAGE, mechanical and electrical engineers, Heathfield Yard, Swansea.—Mr. J. Smith and Mr. J. T. Page have dissolved partnership. Mr. Smith will attend to debts.

WATSON & HARRISON, electrical engineers, 93la, Chester Road, Stretford, Manchester.—Mr. D. Watson and Mr. H. E. Harrison have dissolved partnership. Debts will be attended to by Mr. Watson.

JOWITT & HOPKINSON, electrical engineers, 19, Bull Close Lane, Halifax.—Mr. C. Jowitt and Mr. G. Hopkinson have dissolved partnership. Mr. Jowitt will attend to debts and continue the business in his own name.

EWBANK & SON AND THE ELECTRICAL CONTRACTING AND MOTOR CO., motor engineers and electrical contractors, Town End, Pontefract.—Messrs. R. & R. W. Ewbank have dissolved partnership. Debts will be attended to by Mr. R. Ewbank, who will continue the business under the same styles.

Trade Announcements.—MESSRS. WILLIAM ALLAN & CO., of Liverpool, have appointed Messrs. W. C. Yuille & Co., of 48, York Street, Glasgow, sole agents for their "Nalla" adaptors, for the whole of Scotland.

THE LIBRARY PRESS, LTD., has removed both its general offices and warehouse to larger premises, at 83, Southwark Street, London, S.E.1.

THE ELECTRICAL SERVICE CO., which has opened branch premises at Dudley's Chambers, High Street, Watford, desires to receive manufacturers' and factors' catalogues.

MESSRS. RUSTON & HORNSBY, LTD., have removed their London office to Imperial House, 15-19, Kingsway, London, W.C.2. as from March 31st.

THE CENTRAL ELECTRICAL CO., of 46, Barker Street, Oldham, has opened a branch business at 29, Mumps, Oldham.

MESSRS. HICK, HARGREAVES & CO., LTD., inform us that their Soho Iron Works, Bolton, will be closed for stocktaking from Saturday, March 29th, to Wednesday morning, April 2nd.

MR. J. P. FITZWATER, electrical engineer, of Stroud (Glos.), has removed his business to 2, John Street.

The registered office of THE ISLE OF THANET ELECTRIC TRAMWAYS & LIGHTING CO., LTD., has been transferred to Crown House, Aldwych, London, W.C.2.

Catalogues and Lists.—MESSRS. WATSHAM'S, 35, King Street, Covent Garden, W.C.2. Illustrated and priced pamphlets dealing respectively with the "Magniphone" headphones, and "Amplifier" audio-frequency transformers.

THE ENGLISH ELECTRIC CO., LTD., Queen's House, Kingsway, W.C.2. Publication No. 330, illustrating and describing the "English Electric" cylindrical balanced valve; and Publication No. 519 dealing with the "English Electric" suction tube.

MESSRS. FALK, STADELMANN & CO., LTD., 83-87, Farringdon Road, E.C.1. An illustrated price list of glassware for electric lighting.

MESSRS. HIGGS BROS., Sand Pits, Birmingham. March price list of a.c. and d.c. motors, starting gear, &c.

THE LOMBARD ELECTRIC CO., Lombard Street, Southwark Bridge Road, S.E.1. An illustrated price list of bridge-type fuseboards.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2. A new price list of electric lighting fittings for use with List No. 340. Also a price list of small-power motors and lamp locks.

THE WHITWORTH ELECTRIC LAMP CO., LTD., 195, North End Road, West Kensington, W.14. A net trade price list of electrical wiring supplies, radio apparatus, switch- and fuse-gear, and bell material.

THE EDISON SWAN ELECTRIC CO., LTD., 123-5, Queen Victoria Street, E.C.4. An "artistic fixtures" catalogue illustrating lighting fittings and many patterns. Also an illustrated catalogue of heating and cooking appliances.

MESSRS. H. C. SLINGSBY, 89, 95, and 97, Kingsway, W.C.2. List No. 239, dealing with portable stackers of various designs.

BRITISH INSULATED & HELSBY CABLES, LTD., Prescot, Lancs. A list of the company's many manufactures.

MESSRS. ADAM HILGER, LTD., 75a, Camden Road, N.W.1. Two illustrated publications dealing with Dr. Müller's X-ray spectrograph.

MESSRS. HARDY & PADMORE, LTD., Worcester Foundry, Worcester. Sheet No. 9110, illustrating a new sub-station ventilating column and a new lamp pillar.

THE WALTHAM MANUFACTURING CO., 2, Jackson Road, Holloway, N.7. A priced and illustrated leaflet describing the "Waltham" reception cushion in which is concealed a telephone earpiece.

BROOKHIRST SWITCHGEAR, LTD., Northgate Works, Chester.—Calendar cards for April, May, and June, bearing illustrations of an automatically-controlled compressor set, a hand-operated control panel, and a hand-operated panel controlling a 150-h.p. motor respectively.

MESSRS. HANS RENOLD, LTD., Burrage Works, Didsbury, Manchester.—A well-illustrated treatise upon chains for conveying and elevating machinery.

THE CENTRAL ELECTRICAL CO., 3, Low Pavement, Nottingham.—A booklet describing the "Clifton" continuity lighting system.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Small Motor List No. 10/02, describing and illustrating a motor of 1/40 h.p. Priced.

MESSRS. EVERSHED & VIGNOLES, LTD., Acton Lane Works, Chiswick, W.4.—A detailed and illustrated brochure upon the "Megger" and "Bridge-Megger" testing sets.

Book Notices.—"Notes on Protective Gear," by A. Hilton Higgs. Pp. 32; 52 figs. Hollinwood: Messrs. Ferranti, Ltd.—This production (pamphlet Ga. 240) will be of interest to the engineering community; it surveys the development from the earliest times of apparatus intended to protect automatically electrical machinery, switchgear, and conductors from damage caused by excessive current flowing through them, defects in insulation, or other abnormal conditions; thus conveying a definite idea of the general possibilities and uses of such gear. The functions of protective gear are defined, and the chief features which it should possess are indicated. The author next describes with the aid of wiring diagrams the various types of gear used for protecting (*a*) alternators, (*b*) transformers, (*c*) cables and overhead lines, and (*d*) switchgear, a brief summary of the advantages and limitations of the methods available for the particular cases being added at the end of each section.

The Decimal Educator, March, 1924. London: The Decimal Association. Price 6d.—The March issue of this journal deals largely with the conference which the Association is to hold in July, to which delegates from all the Dominions have been invited. Mr. R. Cockburn Millar deals with "The Simplicity of the Decimal System," and among other articles is one on "Arithmetick," by Mr. E. C. Barton.

"Fuel Economy in Steam Plants," by A. Grounds. Pp. ix + 104; figs. 13. London: Sir Isaac Pitman & Sons, Ltd. Price 5s. net.

Journal of the American Institute of Electrical Engineers. Vol. xliii. No. 3. March, 1924. New York: The Institute. $1.

"Colliery Year Book and Coal Trades Directory for 1924." London: The Louis Cassier Co., Ltd. Price 21s. net.

"Tuning Coils and How to Wind Them," by G. P. Kendall. London: Radio Press, Ltd. Price 1s. 6d.

E.D.A. Sales Conferences.—The last conference of the present session will be held on Friday, April 11th, at 7.30 p.m. at the London School of Economics. Mr. W. Y. A. Anderson will read a paper on "Selling Electric Power," and the chair will be occupied by Mr. B. Longbottom.

Engineering Wages at Home and Abroad Compared.—*The Ministry of Labour Gazette* gives the following table of comparative real wages in London and certain capital cities abroad in January, 1924. (Index numbers of comparative real wages, 1924.)

Occupation.	London.	Amsterdam.	Berlin.	Brussels.	Christiania.	Ottawa.	Paris.	Prague.	Stockholm.	Vienna.	Warsaw.
Engineering Trades.											
Skilled:											
Fitter	100	98	46	68	99	195	94	125	79	55	48
Ironmoulder (hand) ...	100	85	—	68	99	192	100	111	79	—	48
Patternmaker	100	91	43	91	93	212	20	—	74	54	44
Turner	100	98	46	70	99	195	100	103	79	68	48
Unskilled:											
Labourer	100	101	53	69	101	183	100	97	95	54	48

Local Exhibitions.—Stafford.—The Corporation Electricity Department recently organised an exhibition of domestic electrical apparatus. The Birmingham branch of the General Electric Co., Ltd., and the Jackson Electric Stove Co., Ltd., arranged effective displays.

Greenock.—An exhibition of electrical appliances under the auspices of the Corporation Electricity Department was recently held at Gourock. Large numbers of visitors were interested in demonstrations of, and illustrated lectures on the use of the appliances.

Doncaster.—The Metropolitan-Vickers Electrical Co., Ltd., in conjunction with the Bessecar (Doncaster) Electric Society, Ltd., recently held at Staniland's Rooms, Doncaster, a public exhibition of domestic electrical appliances of all kinds, demonstrating the value and economy of electricity in lighting, heating, cooking, &c.

British Empire Exhibition Notes.—There was some discussion in the House of Commons last week regarding the Exhibition arrangements. Mr. Ben Tillett criticised the administration, complained of want of organisation in respect of accommodation, and asked whether it was supposed that the Exhibition would be ready on the appointed day. Mr. J. H. Thomas, the Colonial Secretary, in replying, said that criticism of early blunders would not help matters within four weeks of the opening time. He said that the Exhibition would be completed and would be opened on the advertised date (April 23rd). He expressed Government confidence in the success of the Exhibition. It is announced that Lieut.-General Sir Travers Clarke has, at the request of the Board of the British Empire Exhibition, taken up the appointment of chief administrative officer to the Exhibition. He has accordingly resigned his seat upon the board and his position as deputy-chairman. The administrative offices of the British Empire Exhibition have been removed from Grosvenor Gardens to Wembley, where the organisation staff is now located. Sir James Stevenson is chairman of the Board of the Exhibition, and Sir Travers Clarke was his deputy-chairman.

Contributions to E.D.A. Display.—The *Hampstead Advertiser* reports that at a recent meeting of the Marylebone Borough Council, Alderman Duncan Watson protested against the proposed contribution of £300 towards the cost of the E.D.A. exhibit at Wembley. He held that it would be *ultra vires* to spend money outside the borough unless direct results were anticipated. The Council decided, however, to make the payment, although the cheque is to be held up pending a decision upon the legality or otherwise of the procedure.

Strike of Electricians.—On Monday night 400 members of the Electrical Trades Union ceased work as a protest against the employment by Messrs. Troughton & Young of a foreman stated to be a non-unionist. The National Association of Supervising Electricians, of which the foreman concerned is a member, asked the E.T.U. to confer with it on the matter, but the proposal was rejected.

It was announced on Tuesday that the matter had been settled and that the men would return to work at once.

The Tramway Strike.—After a number of abortive conferences and discussions, the employés of the London tramway undertakings ceased work as from midnight, March 21st, and the omnibus employés "came out" in sympathy with them.

The men had asked for a general increase in wages of 8s. per week, their principal argument being the disparity existing between their present rates and those paid to the employés of the omnibus undertakings. A number of tramway undertakings offered smaller increases, ranging from 2s. to 5s. per week, but the offers were rejected. Arbitration was suggested, but this was also refused, and the intervention of the Minister of Labour proved fruitless. On March 21st the Ministry of Labour set up a Court of Inquiry to investigate the circumstances of the dispute. The Court consisted of Sir Arthur Colefax, K.C. (chairman), Mr. G. W. Paton (managing director of Messrs. Bryant & May), and Mr. Arthur Pugh (secretary of the Iron and Steel Trades Confederation).

The Court sat and took evidence on Saturday and Sunday last. Mr. Ernest Bevin presented the men's case "without prejudice," and a number of representatives of the employers gave evidence. Mr. F. Pick (L.G.O.C.) gave it as his opinion that better wages and better dividends could be paid if the traffic systems were co-ordinated. In reply to a question by Mr. Bevin, Lord Ashfield said that neither he nor his colleagues had ever held the view that tramways would be superseded by motor omnibuses. The tramways would continue to play an important part in dealing with the transport of London traffic. The present methods of dealing with passenger transport could not possibly secure to the public, to the employés, or to the investors a satisfactory position. This was an industrial dispute, but it arose out of the financial situation. Tramways could not continue in the present circumstances, and this was equally true of the omnibuses and underground railways. Asked if he was in favour of a general pooling of fares, Lord Ashfield said that he did not think there was any other way of dealing with the London traffic problem than by complete co-ordination of all the transport facilities, all of them being worked under a directing authority, public in character, which would see that the fares charged were only sufficient to provide a fair return on the capital invested and adequate wages. Moreover, it would see that the public received what was necessary in the way of service, and no more. Answering further questions by Mr. Bevin, Lord Ashfield said that he would be glad to see the tramwaymen's wages advanced, but he saw no way of doing it with the finances as they were.

A number of witnesses gave evidence on behalf of municipal undertakings to show that it was not practicable to grant the demanded increases in wages. Towards the end of the inquiry Mr. Bevin contended that none of the witnesses had contested the merits of the men's demands; they could not be held responsible for the chaotic conditions which prevented the granting of the increase. The chairman announced that the Court would adjourn, and not sit again unless it was decided that further evidence should be taken.

On Monday the Court issued an interim report indicating the form which the conclusions of the Court would take. It appeared from the evidence that the merits of the men's claim were not seriously questioned, but that the undertakings were unable to sufficiently meet the claim. Higher fares were no solution; there was little prospect of improvement in the condition of the industry without some co-ordinating control of London passenger traffic. A definite undertaking by the Government to introduce legislation to effect control was necessary before negotiations could be resumed between the employers and the men.

A Bill was introduced by the Minister of Transport on Tuesday dealing with the matter.

The London companies' position in the matter was put forward in a statement made by Lord Ashfield on March 21st. He pointed out that the three companies operating in Greater London—the Metropolitan Electric Tramways, the London United Tramways, and the South Metropolitan Electric Tramways—after meeting fixed charges, in 1923, were only able to set aside £69,208 for renewals—a totally inadequate amount. The return upon the capital invested (£2,944,186) was only £19,682, representing less than two-thirds of one per cent. The position for the first two months of the current year was worse still, for the companies had failed to meet their fixed charges, let alone provide for renewals. It had been seen, too, that the tramways' loss had not been the gain of the railways or omnibuses. The undertakings were carefully and economically managed; there were no extravagances. The increasing of fares destroyed traffic, and was useless. The companies claimed that they had dealt generously with the public and the staff with the resources at their disposal. The wages of their tramway employés had advanced by 89 per cent. since 1914 in the case of drivers and conductors, while the cost of living had increased by 79 per cent. Capital had never yet received a reasonable return. Last year the three companies paid, on the average, only 2 per cent. upon their total capital.

The agenda for Tuesday's meeting of the London County Council contained a notice of motion by Mr. Emil Davies, who was to submit that the demand for an increase was reasonable and could be paid if the tramway undertakings were relieved of part of the burden of track maintenance, rates, and street-widening costs.

Electricians' Wage Demand.—Speaking at the annual meeting, on March 24th, Mr. James Taylor, chairman of the Midland Electric Corporation for Power Distribution, Ltd., said that the employers of electrical undertakings had received an application for an increase of 10s. per week on basic wages, and negotiations were in progress.

Halifax and the Staff N.J.B.—Correction.—The engineer and manager of the Halifax Corporation electricity undertaking states that we were incorrect in saying (in our last issue) that the Electricity Committee had decided not to rejoin the National Joint Board of Employers and Staff Members of Electricity Undertakings. On the contrary, the Committee has recommended the Corporation to rejoin the Board, and the matter is to come before the Corporation on Wednesday next. We regret that we were misinformed by a correspondent.

Recent Contracts.—The following are some of the larger orders recently received by Batteries, Ltd. (Redditch):—A 208-cell, 435-Ah battery for a shunting locomotive, South African State Railways; a 70-cell, 240-Ah, and a 70-cell, 200-Ah batteries for vehicles, Newcastle-on-Tyne Electric Supply Co., Ltd.; and a locomotive battery (535-Ah, 200 cells) for the Wallsend & Hebburn Coal Co., Ltd.

German Incandescent Lamp Industry.—Although the German incandescent lamp industry has reduced its prices to even below the pre-war level, says the *Boersen Courier*, sales are as slow as ever. It should be noted, however, that the artificial light season is drawing to an end, and that normally sales would be smaller at this time of the year. Since the abolition of the prohibition of imports foreign competition has been extraordinarily lively, especially in South Germany. Business at the Leipzig Fair corresponded more or less to the moderate hopes entertained, but was not sufficient materially to influence the general situation. During the first half of March there was no increase in the dismissals of workers.—*Reuter's Trade Service* (Berlin).

German Imports into New South Wales.—According to a Customs statement forwarded by H.M. Trade Commissioner at Sydney, the value of imports of German origin into New South Wales during the month of November last was £49,735, as compared with £33,491 in October and £25,569 in September.—*Board of Trade Journal.*

New Showroom.—The British Thomson-Houston Co., Ltd., has recently opened a new showroom adjoining its main offices in Campo Lane, Sheffield. This showroom, which is situated on the ground floor, has been tastefully and artistically decorated. The walls are panelled with white

New B.T.H. Showroom at Sheffield.

mouldings, the background being in French grey. The furniture and showcases are made of mahogany, and are in the Queen Anne style. An interesting feature of this showroom is a model shop window, in which can be demonstrated the B.T.H. "X-Ray" system of lighting. The display of fittings in the showroom is very comprehensive, and includes all types of appliances for domestic, commercial, and industrial lighting. Another section of the showroom is given over to the display of heating and cooking appliances.

British Trade-Mark Applications.—The following are among the recent applications for British trade marks. Objections can be entered against any of the proposed marks within one month from the dates mentioned below:—

Crabtree. No. 438,406. Class 13.—Electric metal goods, including switch couplings, fusible cut-outs, and accessories for electric light fittings, &c. No. 438,407. Class 16.—Insulators and insulating materials made of porcelain and earthenware. J. A. Crabtree & Co., Ltd., 21, Upper Rushall Street, Walsall. March 19th, 1924.

Lissenium. No. 444,207. All goods in Class 8.—Lissen, Ltd., Goldhawk Works, Woodger Road, Shepherd's Bush, W.12. March 19th, 1924.

Lissenceptor. No. 444,208. All goods in Class 8.—Lissen, Ltd., Goldhawk Works, Woodger Road, Shepherd's Bush, W.12. March 19th, 1924.

Scott, Made to Limit Gauge (lettering and design). No. 442,745. Class 13.—Sparking plugs. The Scott Motor Cycle Co., Ltd., Saltaire, Shipley, Yorks. March 19th, 1924.

Russian Industrial Notes.—*New Orders.*—The Central Electrical Trust is reported to have recently received various orders resulting from the granting of improved conditions of credit. Among these are mentioned works for a central station at Minsk, the construction of a tramway at Voronesh, the equipment of 20 tramcars for Kharkoff, and the building of a tramway in the vicinity of Baku, while negotiations are proceeding with regard to other proposed tramways and central stations.

A British Representative's Visit.—It is stated that the Chief Concession Commission has granted an application said to have been made by Messrs. Babcock & Wilcox, Ltd., for permission for their former representative in Russia to visit that country on an information journey and to give consultations on technical questions. The right to carry on trading activity is excluded from the permission.

Electrical Boring for Oil.—The Central Electrical Trust reports having received a telegram from Baku announcing that boring operations by a new electrical system are giving excellent results superior to those obtained by the use of steam plant. The electrical plant was constructed at the Moscow "Dynamo" Works, and was only dispatched to Baku early in January. One of the principals of the Baku Oil Trust (Azneft) is reported to have stated that having seen the plant in operation he considers it to be better than American appliances.

The Telephone and Telegraph Trust.—The Weak Current Trust, which comprises six works, of which four are situated in Petrograd and one in Moscow, also has erecting departments in these two cities for the purpose of carrying out telephone installations, railway signalling work, radio stations, &c. As all the radio work has been concentrated in Petrograd, the radio laboratory at Moscow is now being transferred to that city. The unfilled orders on the books of the trust at the beginning of the new financial year, October 1st, 1923, represented 3,019,000 roubles, and the production in the December quarter amounted to 1,058,000 roubles, or exactly the value scheduled for that period.

Petrograd Lighting Co.'s Shares.—Based upon the Treaty of Versailles, the Reparations Commission some time ago demanded the surrender of the shares held by German interests in the Petrograd Electric Lighting Co. of 1886. According to German reports, the Commission has now sold a considerable portion of the shares thus handed over at the low price of 25 Swiss fr. per share (ordinary and preference), the numbers thus disposed of being 17,002 of the former and 5,803 of the latter. The last quotation for the shares in Zurich was 110 fr. Some value must be attached to the shares, for, although the company was deprived of its works in Petrograd and Moscow, it still remains the owner of a large works at Lodz, which is in course of being converted into a Polish company.

A Re-plating Service.—Messrs. J. & W. B. Smith, Ltd., Farringdon Road, E.C.1, draw our attention to their re-plating service (re-lacquering, bronzing, burnishing, gilding, silver-plating, &c.), which they think may be of value to electrical contractors in the renovation of old stock.

German Engineering Industry.—In a report on the German engineering industry the *Deutsche Bergwerks-Zeitung* says that the better tendency observed in January developed, although not to any great extent, during February. Chief of all troubles is the lack of money and credit, the former of which, at least, has been felt even more acutely, rendering the conclusion of contracts difficult. The increase in inquiries, especially from home firms, shows that many schemes are being considered, the execution of which, however, in most cases must be deferred owing to lack of funds. Rather more inquiries have also been received from abroad, leading, however, to even fewer orders than the home inquiries. In view of the severe foreign competition the prospects for orders from abroad are at present very poor. At most establishments a greatly reduced number of hours, as previously, have been worked, with a smaller number of hands. In order to do business, concessions, both in prices and conditions of payment, have been necessary in many cases. No further reduction in the cost of raw materials has proved feasible owing to the M.I.C.U.M. agreements, the high freight rates and the price of coal. The introduction of longer working hours did not take place smoothly everywhere, strikes and lock-outs resulting in some districts. Supplies of raw materials and fuel have been sufficient, and no anxiety regarding these is felt for the immediate future. The decisive factor, not only for employment in the German engineering industry, but in Germany's economic life as a whole, will be the development of the political situation.—*Reuter's Trade Service* (Berlin).

The Flat Rate on Coal.—The Railway Rates Tribunal has now promulgated its decision upon the application of the Mining Association of Great Britain and the National Association of Coke Bye-Product Plant Owners for the abolition of the flat rate of 2d. per ton upon the charges for the carriage of coal. In pronouncing the judgment of the Tribunal, the chairman (Mr. W. B. Clode, K.C.) said that the evidence showed that there were differences between the cost of carriage of coal and other merchandise, but respondents (the railway companies) had shown that the reductions granted to other traffics were justified, and did not involve hardship or injustice to the applicants. The application was dismissed on this, and other grounds.

A French Electrical Bank.—A well-known French economist has just repeated a suggestion made to him by a banker in favour of the establishment of a bank for the electricity industry, which would be composed by uniting the interests of producers owning either hydro-electric works or steam generating stations, of consumers and of capitalists in a harmonious whole. The object would be to grant loans to electricity undertakings, after due inquiry by its own expert bureau, and from comparatively small amounts the loans would be increased to considerable sums once the success of the undertakings had been assured.

New French Company.—A new company has lately been formed in Paris with a capital of 20,000,000 fr., and the title La Société Hydro-Electrique de la Diega, to establish plant to utilise certain available water power. The Société des Hauts Furneaux et Fonderies de Pont-à-Mousson is interested in the new undertaking.

Large Railway Works.—Orders and contracts in connection with the London, Midland & Scottish Railway's expenditure of £14,000,000 for renewals and reconstruction work are being allocated from day to day with beneficial results on the labour market in the many districts over which this work is distributed. The orders for new locomotive boilers number 700, of which 70 have been allocated to Messrs. Vickers, Ltd., Barrow, 50 to the Vulcan Foundry, Ltd., Newton-le-Willows, 30 to Kerr, Stuart & Co., Stoke, 50 to Ruston & Hornsby, Ltd., Lincoln, and 50 to Beyer, Peacock & Co., Ltd., Manchester. The remainder will be made in the company's own workshops as follows: 200 at Crewe, 100 at Horwich, 100 at Derby, and 50 at St. Rollox. The company's carriage and wagon-building programme comprises 15,000 goods wagons of various types and 518 passenger train vehicles, of which 46 are ambulance vehicles converted into brake and parcels vans. Five thousand two hundred of the goods wagons will be obtained from outside firms, but 9,800 will be made in the company's works at Earlestown, Wolverton, Derby, and Newton Heath. In connection with this work large and widely-distributed orders for material have been placed, including an order for tinned copper wire from Callender's Cable & Construction Co., Ltd., London.

For Sale.—Lancaster Corporation Electricity Department has for disposal one 300-kW Belliss-Westinghouse d.c. generating set, two 30 ft. by 8 ft. Lancashire boilers, with Meldrum furnaces and Belliss mechanical stokers, one Green's economiser, one 60-kW d.c. generator, pumps, tanks, &c. Burnley Borough Council Electricity Works invites offers for one 250-kW Belliss-Morcom generating set with condenser pump, piping, and spare armature. (See our advertisement pages to-day.)

Patent Restoration.—An Order has been made restoring Letters Patent No. 30,478 of 1909 granted to Charles Edwin Foster for "Improvements in or relating to pyrometers."

Unemployment.—There was a further reduction in the number of registered unemployed persons during the week ended March 10th, when the total stood at 1,113,600 as compared with 1,134,742 a week previously. The reduction since the beginning of the year has been 172,023.

The *Ministry of Labour Gazette* for March analyses the unemployment figures as they appeared on February 25th. It shows that while the general average of unemployment for all industries was 10.7 per cent., in the electrical engineering industry the figure was only 5.7 per cent. In the electrical wiring and contracting industry the unemployment figure was 9.3 per cent., and in the cable, wire, and electric lamp industries 7.9 per cent. In the tramway and omnibus services unemployment was as low as 3.5 per cent.

Copper and Lead Prices.—Messrs. F. Smith & Co. report March 25th:—Copper (electrolytic) bars, sheet and rods, no change.

Messrs. James & Shakespeare report March 25th:—Copper bars (best selected), sheet and rod, no change; English pig lead, £37 10s., 30s. increase.

Chinese Trade Mark Law.—The Diplomatic Body has received a letter signed by the chairman of the Foreign Chamber of Commerce in Shanghai, protesting against the recognition of the proposed Chinese Trade-mark Law. The letter emphasises that whereas, under European, American, and Japanese laws, an appeal from the registrar of trade marks can be made to a court of justice, the proposed law makes no such provision, with the serious consequences that the registration bureau is constituted the sole arbiter in disputes regarding registration or infringement of the law and that foreigners will thus be placed under Chinese jurisdiction. The letter concludes by pointing out that the alleged protection which foreign trade mark owners will get if they register is wholly illusory, as no law promulgated by the Central Government commands the slightest respect in the provinces.—*Reuter* (Peking).

Lighting and Power Notes.

Barnsley.—Loan.—The Town Council is applying to the Electricity Commissioners for sanction to the borrowing of £8,150 for mains.

Special Order.—Application has been made to the Electricity Commissioners for a Special Order authorising the Council to extend its area of electricity supply so as to include the urban districts or Ardsley, Monk Bretton, and Worsborough, and to acquire the undertakings of the Electrical Distribution of Yorkshire, Ltd., in the areas named.

Bedwellty.—Loan Sanctioned.—The Urban District Council has received the sanction of the Electricity Commissioners to a loan of £5,000 for street lighting by electricity at Cefn Forest.

Bethesda. — Electricity Supply. — The Urban District Council is negotiating with the North Wales Power Co. for a supply of electricity for the district.

Biggleswade.—Electricity Supply.—The Urban District Council has adopted the scheme submitted by First Garden City, Ltd., for a supply of electricity to the district. The supply will be obtained from the power station at Letchworth, and the charges proposed are as follows:—Lighting: 10d. per kWh. Power: Flat rate of 3d. per kWh; sliding scale, from 3d. to 2d., according to quantity consumed. Heating and cooking: 2d. per kWh.

Birmingham.—Electricity Supply.—The Corporation has given notice of its intention to alter the pressure of electricity supply in Aston Manor from 230 and 460 V, and in Handsworth from 240 and 480 V to the standard pressure of 220 and 440 V in both districts.

Burnley.—Electricity Supply.—The Electricity Committee has been informed that the Mid-Lancashire District Electricity Order has been confirmed by Parliament, and that a Statutory Board will now be established. The Electricity Commissioners have appointed Alderman T. E. Higham, cotton manufacturer, of Accrington, to act as provisional chairman of the Board.

Canada.—Hydro-Electric Development.—According to a *Reuter* message, in conformity with the joint agreement with the United States respecting the proposed navigation and power development scheme of the St. Lawrence River between Montreal and Lake Ontario, the Government has appointed a committee of engineers to investigate the feasibility and cost of the scheme, which is estimated at £50,000,000.

Continental.—Poland.—A large generating station has recently been completed at the works of the Société des Hauts Fourneaux et Usines d'Ostrowice to supply the power required in various sections of the works.

Greece.—An agreement has been signed between the Minister of Communications and a group of French capitalists, whereby the French concern is to erect three power stations near the waterfalls of Selinous, Krathys, and Borraikos, which will have a capacity of 75,000 h.p. The electrical energy will be transmitted for distribution in Athens.

Crewe.—New Plant.—The Corporation is to install new plant at the electricity works and to erect a sub-station at Whitegates at an estimated cost of £15,000.

Dronfield (Derbyshire). — Electricity in Bulk. — The Urban District Council has approved of a scheme for obtaining a bulk supply of electricity from the Sheffield Corporation.

East Anglia.—Special Order.—Application is being made to the Electricity Commissioners by the East Anglian Electricity, Ltd., for a Special Order authorising it to supply electricity within the urban district of Diss, in the County of Norfolk, the boroughs of Beccles and Eye, and certain urban and rural districts in the Counties of East and West Suffolk, and a number of urban and rural districts in the County of Essex.

Ellesmere (Salop).—Electricity Supply.—The Gwynedd Trust, Ltd., and the North Wales Power Co. having communicated with the Urban District Council with regard to a supply of electricity for the district, the Council has appointed a committee to consider the question.

Epsom.—Inauguration of New Plant.—On March 22nd, the new Vickers Petter-Holmes heavy oil generating set, recently installed at the Council's power station, was formally started up by Mrs. C. G. Irish, and the West Hill feeder cable switched on by Mrs. A. C. Gilling.

Federated Malay States.—Hydro-Electric Development.—The American Consul at Penang reports that proposals have been made to harness the Perak River in order to provide power for the tin mines in the district and also for railway traction purposes. Surveys have been made of a dam site above Enggor, whence transmission lines would be erected close to roads or railway lines, thus keeping the cost of construction and maintenance at a low level. It is estimated that the total energy available from the Perak River is 20,000 kW. Local engineers recommend that generation should be three-phase, 50 or 60-cycle a.c., stepped up to 66,000 V for transmission. Sub-stations should be installed throughout the area of supply, where the pressure would be stepped down to 416 V. It is further recommended that outdoor sub-stations be installed wherever practicable. When the scheme is completed, electricity will be available for the mines in Kinta and Larut and for the towns in Kinta. It will also be possible to supply the new port at Prai.

Glasgow.—Water-Power Scheme.—The Public Health Committee has considered a report by the City Engineer with regard to a proposal to utilise the water of the River Mouse for the purpose of generating electricity for Bellefield Sanatorium, and has instructed the Town Clerk to ascertain the terms on which the necessary ground could be procured.

Greenock.—Extension of Supply.—The Law and Finance Committee has agreed to include the parish of Inverkip in the Corporation's area of electricity supply.

Isle of Man.—Proposed Hydro-Electric Development.—The Tynwald Court has appointed a committee to consider the possibilities of utilising water power for generating electricity.

Lichfield.—Electricity Supply.—The Town Council has engaged Mr. W. W. C. Hawtayne, consulting electrical engineer, to advise the Council with reference to an electricity supply for the city. A canvass of the residents is to be made to ascertain the demand for a supply.

London.—St. Pancras.—The Electricity and Public Lighting Committee recommends that one-third of the profits on the working of the electricity undertaking be left at its disposal for the purpose of developing the undertaking and building up the reserve fund. The Finance Committee, however, has reported unfavourably upon the proposal.

Luton.—ELECTRICITY ORDER.—The Rural District Council has consented to the application of the Luton Town Council for a Special Order authorising it to supply electricity in the rural area.

North Berwick.—ELECTRICITY SUPPLY.—The Town Council has decided to reopen negotiations with the North Berwick Co. with a view to obtaining an electricity supply, and is applying for a Special Order.

Perth.—MAINS EXTENSIONS.—The Electricity Commissioners have approved of an extension of the mains to new houses at Gannochy, &c.

Portsmouth.—ELECTRICITY IN BULK.—The Town Council is applying to the Electricity Commissioners for a Special Order authorising it to supply electricity in bulk to Chichester Corporation and to Fareham Urban Council, and to supply electricity in the rural districts *en route*. The provisional agreement for the supply in bulk provides for a rate of £5 per kVA per annum, plus .7d. per kWh if the annual supply does not exceed 500,000 kWh; at £4 10s. per kVA, plus .7d. per kWh for a supply exceeding 500,000, but not above 750,000 kWh; and at £4 per kVA per annum, maximum demand, plus .7d. per kWh for over 750,000 kWh. The total cost of the scheme is £47,000.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

WHITEHAVEN.—Lighting: From 6½d. to 6½d. per kWh. Maximum demand rate: From 3d. to 2½d. per kWh. Heating and cooking: From 1½d. to 1¼d. per kWh. Power: A reduction of ¼d. per kWh.

LEIGH (LANCS.).—Lighting: From 40 to 30 per cent., above the pre-war rate. Ordinary power and heating: From 55 per cent., to 40 per cent. Large a.c. supplies: From 60 per cent. to 40 per cent.

BETHNAL GREEN.—Electricity for all purposes to be reduced from 2d. to 1½d. per kWh after 30 hours' use per month of the maximum demand.

South Africa.—JOHANNESBURG.—The Municipal Council has received the sanction of the Electricity Commissioners to the installation of a 10,000-kW set at the existing municipal power station. The estimated cost of the new plant is £50,000.

St. Ives (Hunts.).—ELECTRICITY SUPPLY.—The Town Council has decided to take no further action in connection with the electricity scheme for the town until the results of the proposed improvements at the works of the gas company are seen. The estimated cost of carrying out the electricity scheme is £20,000.

Stirling.—ELECTRICITY SUPPLY.—The fuel economiser at the power station, having failed, is to be replaced at a cost of £1,000. A new cable is to be laid in Clifford Road at a cost of £900.

Surrey.—SPECIAL ORDER.—The Urban Electric Supply Co., Ltd., has applied to the Electricity Commissioners for a Special Order, authorising it to supply electricity in certain parishes in the rural districts of Reigate and Godstone.

Swansea.—LOANS.—The Corporation is applying to the Electricity Commissioners for sanction to the borrowing of £10,680 for coal-conveying plant. Sanction has been received to the borrowing of £36,406 for new plant.

Taunton.—ELECTRICITY SUPPLY.—The Town Council has decided to discontinue the minimum charge of 5s. per meter per quarter in connection with electricity supplied to private houses for domestic purposes. An Order is to be applied for enabling the Council to extend its area of supply so as to include the parishes in the area of the Taunton Rural Council.

Tenterden (Kent).—SPECIAL ORDER.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising Major B. J. Day and Lt.-Col. C. B. Bartley to supply electricity in the borough and rural district of Tenterden.

Ticehurst.—OPPOSITION TO ORDER.—The Rural District Council has decided to oppose an application by the Wadhurst and District Gas Co. for an Order to supply electricity in the district.

United States.—NEW "COMBINE."—A new combination of companies was announced on March 21st. The Coalfields Super-power Group, as it is to be called, unites in a co-operative association 11 power companies capable of developing two million horse-power for distribution over Pennsylvania, Maryland, Virginia, West Virginia, and Ohio. The companies, with their 40 stations, represent an investment of $315,000,000 (£63,000,000). Through this combination it is estimated that many millions of dollars will be saved annually, as the companies will no longer have to maintain separate emergency power machinery. This combination completes one link of the system proposed by Mr. Hoover, Secretary of the Department of Commerce, which ultimately would include the New England, Niagara, Chicago, and Southern-Western units. The members of the new association are the Duquesne Light Co., the Pennsylvania Public Service Corporation, the Potomac Edison Co., the American Gas and Electric Co., the Cleveland Electric Illuminating Co., the Ohio Public Service Co., the Pennsylvania and Ohio Electric Co., the Northern Ohio Traction and Light Co., the Pennsylvania Central Light and Power Co., the Keystone Power Corporation, and the West Pennsylvania Power Co.—*The Times*.

Wallasey.—PLANT EXTENSIONS.—Mr. B. T. Hawkins, the borough engineer, recently lectured to the Seacombe Ratepayers and Improvement Association on the local electricity undertaking. He mentioned that two new Babcock and Wilcox boilers of 35,000 lb. per hour vaporative capacity, with economisers, and an additional 5,000-kW Brush-Ljungström turbo-generator had been ordered to replace the 1,000-kW set which was now being superseded. A new electrically-operated, sixteen-panel, remote-control, 6,600-volt switchboard, by the Metropolitan-Vickers Co., was to be installed this spring.

BREAKDOWN.—Due to a small explosion at the generating station on March 16th, the supply of electricity was cut off between 5 p.m. and 9 p.m. The explosion occurred in a cubicle in the switchboard. The tramway service was also suspended.

Warrington.—SPECIAL ORDER.—The Corporation is applying to the Electricity Commissioners for a Special Order, authorising it to extend its area of electricity supply so as to include the urban district of Lymn.

Whitehaven.—LOAN.—The Town Council has applied to the Electricity Commissioners for sanction to the borrowing of £1,015 for mains, &c.

Tramway and Railway Notes.

China.—PEKING.—It is anticipated that the Peking tramway scheme will shortly be completed. The power station which will supply the current for the tramways is under construction at Tungchou. Fifty cars will be brought into service.

Continental.—SPAIN.—It is proposed to construct an electric railway between Santiago and Corunna, and the promoters of the scheme have applied to the Government for authority to proceed with the work.

RUSSIA.—The first electric tramway constructed under Soviet auspices was recently opened at Baku, and a second has been started at Borogodsk in the district of Moscow. The latter is nine versts (5.94 miles) in length and forms a connection between two textile works.

Japan.—TOKIO.—Plans for the construction of tramway subways in Tokio are being considered by the city engineers. It is proposed to construct six double-track lines, with a total length of 50 miles.

Light Railways.—The Ministry of Transport has made the Merrivale Light Railway (Revival of Powers) Order, 1924, reviving the powers granted by the Order of 1909.

The Ministry of Transport has made an Order authorising the construction of Longridge-to-Hellifield Light Railway. A great deal of the ordinary capital still remains to be raised, but it is expected that work on the line will be commenced at an early date.

London.—NEW UNDERGROUND RAILWAY.—Preliminary soundings are being made for samples of earth forming the bed of the Thames, near Hungerford Bridge, in connection with the proposed underground railway which will connect up the Hampstead line terminus at Charing Cross with the City and South London Railway at Kennington. This line, when completed, will provide a direct route between Clapham and Edgware.

NEW ROUTE.—The new London County Council tramway along Amhurst Park, N., has been completed, and the tramway service No. 53, between Aldgate and Stamford Hill, was to have been extended on March 23rd *via* Amhurst Park to Finsbury Park, Seven Sisters Road, Parkhurst Road, Camden Road, High Street (Camden Town), Hampstead Road, and Tottenham Court Road. A new service (No. 71) was to have been introduced on the same date between Aldgate and Wood Green, but the opening of these new lines has been held up by the tramway strike.

Stoke-on-Trent.—ACCIDENT.—On March 16th a tramcar jumped the points between Stoke and Newcastle-under-Lyme, crashed through a fence, and was prevented from falling down an embankment 40 ft. deep by running against some trees. No one was injured.

United States.—RAILWAY ELECTRIFICATION.—Work has commenced on the electrification of the Missouri-Kansas-Texas Railway from Dallas to Denton, Texas, a distance of 47 miles. The Texas Construction Co. has been organised to carry out the scheme. The line, when electrified and put in operation, will be a duplicate of the Dallas-Terrell line.—*Electric Railway and Tramway Journal*.

Telegraph and Telephone Notes.

Radio Operators' Strike.—LONDON DISPUTE.—According to *The Times*, a sudden strike of the foreign transmitting and receiving staff of telegraphists at Radio House, London, the main telegraph office of Marconi's Wireless Telegraph Co., Ltd., occasioned a dislocation of the radio service to and from the Continent and the United States on March 21st. Some weeks ago the men submitted a request for an increase in their wages of £4 per month for married men and £2 per

month for single men. Owing to the nature of the reply, which they considered unsatisfactory, the men insisted on an immediate interview with the directors of the company, and failing to obtain an early meeting, they left duty. Later, the men resumed duty pending the continuance of the negotiations. It is reported that the men's request has been granted.

China.—AUTOMATIC TELEPHONY.—Seven hundred automatic telephones, supplied by L. M. Ericsson & Co., Stockholm, are being put in operation in Shanghai, for experimental purposes, by the Shanghai Mutual Telephone Co. It remains to be seen whether climatic conditions favour automatic telephones, and whether the public will pay the increased charges for such a service.

TOLL LINE.—Arrangements are under way for the inauguration of a telephone toll line between Shanghai and Nanking.

Chile.—TELEPHONE EXTENSIONS.—In connection with the decision to convert the Chile Telephone Co. from a British into a national organisation with a largely-increased capital and Chilean stockholders, a substantial amount of new money will be spent on new installations in Valparaiso, Santiago, Vina-del-Mar, Antofagasta, Iquique, Concepcion, Talca, Temuco, and other towns. In the capital, Santiago, a new and larger building will be erected for use in conjunction with the present quarters, while in the service between Santiago and Valparaiso 16 new underground lines will be added to the existing 18. Others will be laid between Santiago, Rancagua, and the more important towns.—*Reuter's Trade Service* (Santiago-de-Chile).

Greenland.—RADIO STATIONS.—The materials and plant for the four radio stations which the Danish Government is to erect in Greenland will be transported to the chosen areas between May and July. It is anticipated that the stations will be in working order by the early autumn.—*Reuter* (Copenhagen).

South America.—FRENCH CABLES.—The Government has introduced into Parliament a Bill granting a delay of four years for the laying of French cables connecting Rio de Janeiro, Montevideo, and Buenos Aires.—*Reuter* (Montevideo).

Sweden.—LONG-DISTANCE TELEPHONY.—Telephonic communication between Haparanda (in Sweden) and Leipzig (in Germany), a distance of about 1,900 miles, will be possible over a line which the Swedish State Telegraph Department tested last week.

Radio Notes.

Brazil.—RADIO ASSOCIATION.—Under the auspices of the Instituto de Engenharia de S. Paulo, there has been organised the "Sociedade Radio de S. Paulo." Its principal purpose is the broadcasting of information, &c. It is planned to install a transmission station with sufficient power to be heard at a range of from 1,000 to 1,500 kilometres.—*Commerce Reports.*

Canada.—BROADCASTING ARRANGEMENTS.—The Canadian National Railways have completed arrangements for the establishment of a chain of seven radio broadcasting stations across Canada, namely, at Montreal, Ottawa, Winnipeg, Saskatoon, Regina, Edmonton, and Calgary. Broadcast programmes will be given twice weekly, including concerts and talks by officials of the system to the employés who have been furnished with receiving sets at 20 per cent. less than cost.—*Reuter* (Montreal).

China.—BAN ON RADIO SETS.—According to *Commerce Reports*, the purchase or operation by Chinese citizens of radio sets has been prohibited by order of the Ministry of Communications. Foreigners living in Chinese territory come under this order, and steps are being taken to prevent the sale of radio apparatus or its installation by Chinese living in the foreign settlements.

Finland.—BROADCASTING SCHEME.—Prof. George von Wendt has submitted a memorandum to the Government proposing the erection of three Government radio stations for the purpose of carrying on a broadcasting service and for relaying foreign, particularly British, broadcast programmes. The amount required for putting the scheme into operation should, the Professor recommends, be included in the supplementary Budget for this year.—*Reuter* (Helsingfors).

Switzerland.—NEW STATIONS.—The idea of erecting a central national broadcasting station has been abandoned, and a system of decentralised stations is now proposed. In view of the fact that there are only about 4,000,000 people in Switzerland, it is quite obvious that broadcasting must be kept within modest bounds. It is reported that stations will be located at Lausanne, Geneva, Zurich, and Basel. The Swiss Federal Government is to place at the disposal of the four stations the larger part of the revenue derived from licences, and other interested bodies are being urged to subscribe to the scheme.—*Commerce Reports.*

Turkey.—PROPOSED BROADCASTING STATION.—A concession for the establishment of a low-power broadcasting station at Constantinople has been applied for by German radio apparatus manufacturers.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Australia.—PERTH.—April 23rd. Postmaster-General's Department. Accumulators.*

Belfast. — April 1st. Board of Guardians. Electric lighting installation at the officers' quarters, and private telephone installation "Strowdger" system at the Union Workhouse. Specification from the Clerk of the Union, Clerk's Office, Union Workhouse.

April 7th. Electricity Department. Three-phase e.h.p. a.c. switchgear; three-phase h.p. a.c. switchgear. (March 14th.)

Belgium.—April 3rd. Municipal authorities of Schaerbeek, Brussels. 600 armoured circuit breakers. Particulars from Service de l'Electricité, Hotel Communal, Schaerbeek.

May 7th. Municipal authorities of Saint Gilles, Brussels. Armoured cable for d.c. less than 750 V. Particulars for 3 fr. from Service de l'Electricité, 40, Rue de Bethléem, Saint Gilles, Brussels.

April 2nd.—The Belgian State Railway authorities (Office de l'Electricité), 25, Rue de la Charité, Brussels. Supply and erection of six lots of l.p. receiving and distributing switchboards.

April 25th. Association Liégeoise d'Electricité. Establishment of an electricity distribution system in the commune of Grivegnée, together with transformer cabins. President du Conseil d'Administration de l'Association Liégeoise d'Electricité (Société Co-operative Intercommunale) Gouvernement Provincial, Liége. Particulars for 50 fr.

East Lothian.—For Western District Committee, East Lothian County Council. Wiring for electric lighting for the following housing schemes, viz.:—Gladanuir (4), Longniddy (16), Macmerry (40), Prestonpans (14). Dick, Peddie & Walker Todd, architects, 8, Albyne Place, Edinburgh. Pencaitland (30), Ormiston (30). Greig & Fairbairn, architects, 31, York Place, Edinburgh.

Edinburgh.—March 31st. Midlothian and Peebles District Asylum. Stores, including electrical fittings, for six months. Clerk, 19, Heriot Row, Edinburgh.

April 14th. Electricity Supply Department. Insulated cables, conduits, pavement box frames and covers, house-service fuse boxes. (See this issue.)

Egypt.—CAIRO.—May 31st. Egyptian Ministry of the Interior. Pumping plant, &c., for Mehalla el Kobra. Electric motors and accessories, pumps and accessories, cables, filters, including alum distributing apparatus, switchboards, tools, and plant.*

London.—ST. PANCRAS.—April 2nd. Electricity Department. Six 1,500-kW motor converters. (See this issue.)

Lyme Regis.—April 4th. Town Council. Reorganisation of the electricity generating plant, switchgear, overhead and underground mains, including the supply of a 50-kW crude-oil engine set, accumulators, &c. (March 21st.)

New Zealand.—WELLINGTON.—July 29th. Public Works Department. Turbines and generators.*

Plymouth.—April 10th. Electricity Department. Travelling band condenser circulating water screen. (See this issue.)

South Africa.—DURBAN.—May 2nd. Water Engineer's Department. Shongweni Scheme, Vernon Hooper Dam. Large sluice valves, pipes, water turbine generating plant, &c.*

Stoke-on-Trent.—April 16th. Electricity Department. 12 months' supply of a.c. and d.c. meters and maximum demand indicators. (See this issue.)

Truro.—April 19th. City Council.—Work connected with the proposed electricity undertaking. (March 21st.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Australia.—SYDNEY.—Electricity Supply Committee.

Double-braided aerial cable (£4,927).—Noyes Bros., Sydney, Ltd.
Storage battery, with regulating switches, copper connections, &c. (£83,420).—Tudor Accumulator Co., Ltd.
Charging and milking boosters (£5,349)—English Electric Co. of Australia, Ltd.
Switchgear (£3,945).—Metropolitan-Vickers Electrical Co., Ltd.

The Electric Supply Co., of Victoria, has placed contracts for two 500-kW and two 3,000-kW British Thomson-Houston rotary converters and Ferguson, Pailin switchgear.—*Tenders.*

Ayr.—Town Council. Accepted:—

Electric lighting work at Woodfield Houses (£425).—Mr. Potter, Prestwick.

Belgium.—One Austrian and two Belgian tenders were received last week by the Belgian Post and Telegraph authorities in Brussels for the supply of 200 magneto generators for the telephone and telegraph department. The lowest offer was that of the Bell Telephone Manufacturing Co., Antwerp.

Birmingham.—Board of Guardians. Accepted:—
Electric lighting installation at the Erdington Homes (£1,827).—Smith and Bellhouse.
Electric mains for the sterilisers, &c., at Dudley Road Hospital (£730).—Manley & Regulus.
Electric lighting and power mains for electric lifts at Erdington Homes (£5,330).—W. S. Vaughan, Ltd.

Copenhagen.—The municipality has just placed a very large contract for a complete boiler-house equipment for the municipal electric power supply station with the Vickers Spearing Boiler Co., Ltd., London (an affiliated company of Messrs. Vickers, Ltd.). The contract includes boilers of 2,000 h.p. each, with economisers, stokers, air heaters, superheaters, mechanical stokers, and all accessories. The whole of this plant will be manufactured in Great Britain. The contract was obtained in open international competition.

Dover.—Town Council. Accepted: —
New boilers for the electricity works (£10,023).—Vickers Spearing Boiler Co., Ltd.

Glasgow.—Electricity Committee. Recommended:—
500-V d.c. switchboards for the Parkhead and Virginia Street sub-stations (£2,617).—A. Reyrolle & Co., Ltd.

Libraries Committee. Accepted :—
Electric lighting installation at Partick Library (£371).—J. Hiddleston.

Tramways Committee. Recommended :—
Two cranes for Ballieston and Paisley sub-stations.—Herbert Morris, Ltd.

Housing Committee. Recommended :—
Electric lighting installation at Knightswood housing scheme (£4,964).—Munro & Co.

Government Contracts.—The following Government contracts were placed during February, 1924 :—

ADMIRALTY CONTRACT AND PURCHASE DEPARTMENT.

Batteries.—Hart Accumulator Co., Ltd.
Batteries and cells.—D.P. Battery Co., Ltd.; Chloride Electrical Storage Co., Ltd.
Cells.—Premier Accumulator Co. (1921), Ltd.; Pritchett & Gold & E.P.S. Co., Ltd.
Electrically-operated 30-ton crane.—Cowans, Sheldon & Co., Ltd.
Electric heating elements.—Credenda Conduits Co., Ltd.
Turbo fans.—W. H. Allen, Sons & Co., Ltd.
Blower fans.—Veritys, Ltd.
Turbon fans and motors.—Turbon Patent Fan Co., Ltd.
Ventilating fans.—Sturtevant Engineering Co., Ltd.
Heterodyne units.—H. W. Sullivan, Ltd.
Mercury-vapour rectifiers.—Hewittic Electric Co., Ltd.
Motors, controllers, &c.—Cowans, Sheldon & Co., Ltd.
Platinum strip and wire.—Johnson, Matthey & Co., Ltd.
Repair and modification of telephone receivers.—S. G. Brown, Ltd.
Rotary converter, &c.—English Electric Co., Ltd.

WAR OFFICE.

Oil engine, alternator, &c.—English Electric Co., Ltd.
Transformers.—Ferranti, Ltd.
Electric lighting installation (Devizes Barracks).—J. Lott & Son.

AIR MINISTRY.

Generators and balancers.—Electric Construction Co., Ltd.
Magnetos.—Simms' Motor Units (1920).
Rotary transformers.—W. Mackie & Co., Ltd.
Storage battery.—Premier Accumulator Co., Ltd.
Voltmeters.—Cambridge & Paul Instrument Co., Ltd.

POST OFFICE.

Telephone apparatus.—British Insulated & Helsby Cables, Ltd.; British L. M. Ericsson Manufacturing Co., Ltd.; General Electric Co., Ltd.; Ward & Goldstone, Ltd.; Western Electric Co., Ltd.
Protective apparatus.—British L. M. Ericsson Manufacturing Co., Ltd.; Western Electric Co., Ltd.
Cables.—British Insulated & Helsby Cables, Ltd.; Enfield Cable Works, Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Siemens Bros. & Co., Ltd.; Sterling Telephone & Electric Co., Ltd.
Joint-box castings.—United Steel Companies, Ltd.; Willesden Foundry, Ltd.; J. Williamson & Co.
Ducts.—Albion Clay Co.; Mountford, Phillips & Co. (1920), Ltd.; J. Oakes & Co.; Rainford Potteries, Ltd.; Standard Brick & Terra Cotta Co., Ltd.
Insulators.—Doulton & Co., Ltd.
Insulator rings.—Avon India-Rubber Co., Ltd.
Batteries.—Manchester City Telephone Exchange: Pritchett & Gold and E.P.S. Co., Ltd.
Manufacture, supply, drawing-in, and jointing cable.—London-Purley: Johnson & Phillips, Ltd. Newcastle-South Shields: Pirelli-General Cable Works, Ltd.
Lifts.—Sheffield Telephone Exchange: W. Wadsworth & Sons, Ltd.
Telephone exchange equipment.—Cwmbran (Newport, Mon.) and Ipswich: Automatic Telephone Manufacturing Co., Ltd.; sub-contractors for charging machines: Newton Bros. (Derby), Ltd. For ringing machines: Crompton & Co. For batteries: Premier Accumulator Co. (1921), Ltd. Kirkcaldy: Siemens Bros. & Co., Ltd.; sub-contractors for batteries: Pritchett & Gold & E.P.S. Co., Ltd. For charging machines: English Electric Co., Ltd. For ringing machines: Crompton & Co., Ltd.
Automatic telephone exchange, equipment for.—The United Glass Bottle Manufacturers, Ltd., W.C.2; Cooper Co.'s Stores, Ltd., Liverpool; Jute Industries, Ltd. Dundee: Relay Automatic Telephone Co., Ltd. Northampton and Oxford: Western Electric Co., Ltd.; sub-contractors for batteries: Chloride Electrical Storage Co., Ltd. For ringing machines: Crompton & Co., Ltd.
Telephone repeater station equipment.—Taplow, Marlborough, Aldeburgh: General Electric Co., Ltd. Sub-contractors for engine plant: Ruston and Hornsby, Ltd. For batteries: D.P. Battery Co., Ltd.
Wireless power plant.—Rugby Imperial Wireless Station: British Thomson-Houston Co., Ltd. Sub-contractors for transformers: Brush Electrical Engineering Co., Ltd.

H. M. OFFICE OF WORKS.

Lift.—Holyrood Palace: W. Wadsworth & Son, Ltd.

CROWN AGENTS FOR THE COLONIES.

Cells, parts, &c.—Chloride Electrical Storage Co., Ltd.
Telephone cable, &c.—British Insulated & Helsby Cables, Ltd.

Lancaster.—Electricity Committee. Accepted:—
Four-core and two-core l.p. cables.—British Insulated & Helsby Cables, Ltd.

Sowerby Bridge.
Installation of electric lighting at St. George's Church, school, and vicarage.—Mr. J. Quain.

Stirling.—Corporation. Accepted:—
Electric wiring of the Corporation houses in Broad Street.—Lockhart and Macnab.

Swansea.—Electricity Committee. Accepted:—
Coal-conveying plant at the power station (£10,680).—E. Bennis & Co., Ltd.

Taunton.—Town Council. Accepted. In connection with the change of frequency from 60 to 50 cycles :—
Transformers (£1,522).—British Electric Transformer Co.
Altering 500-kW alternator (£812).—Mather & Platt.

Forthcoming Events.

Institution of Engineering Inspection.—Friday, March 28th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 8 p.m. Paper on "The Commercial Testing of Internal-combustion Engines," by Mr. H. Gutteridge.

Diesel Engine Users' Association.—Friday, March 28th. At the Engineers' Club, Coventry Street, W.1. Paper on "Heavy-oil Engine Indicator Diagrams," by Mr. J. M. Ferguson.

Royal Institution of Great Britain.—Saturday, March 29th. At 21, Albemarle Street, W.1. At 3 p.m. Lecture on "Properties of Gases in Vacua," by Prof. Sir E. Rutherford, F.R.S.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, March 31st. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "Economics in Engineering," to be opened by Mr. F. Gill, O.B.E.

(North-Western Centre).—Tuesday, April 1st. At the Engineers' Club, Manchester. At 7 p.m. Annual meeting.

(East-Midland Sub-Centre).—Tuesday, April 1st. At Leicester. At 6.45 p.m. Paper on "Steam Evaporators and their Application," by Messrs. J. B. MacLean and E. G. Boissier.

(South-Midland Centre).—Thursday, April 3rd. At the University, Birmingham. At 7 p.m. Ordinary meeting.

(Wireless Section).—Wednesday, April 2nd. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 6 p.m. "Thermionic Valves with Dual Emitting Filaments," by the Research Staff of the General Electric Co., Ltd.

Electrical Power Engineers' Association (Southern Division).—Friday, April 4th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 7 p.m. Lecture on "The Parallel Operation of a.c. Power Stations," by Mr. O. Howarth.

Junior Institution of Engineers.—Friday, April 4th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "Mineral Oils, with Special Reference to Lubricating and Insulating Oils," by Mr. A. J. Sears.

Edinburgh Electrical Society.—Friday, April 4th. At the Philosophical Institute. At 8 p.m. Paper on "Turbine Construction," by Mr. H. G. Fraser.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names of makers or suppliers of :—

RIVIERA bowl fittings.
STONEY'S patent punkah wheels.

Notes.

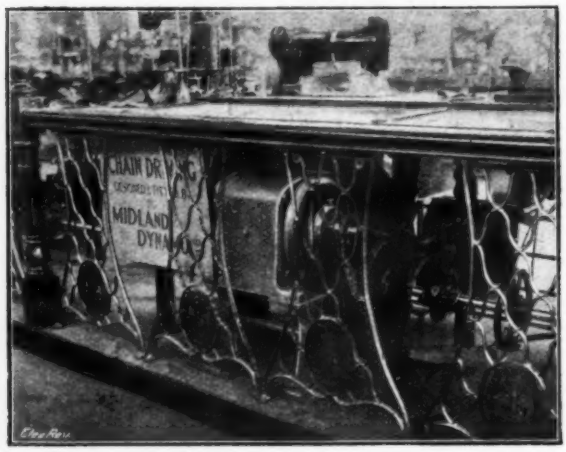
Inquest.—On March 21st an adjourned inquest was held on Charles Morris (25), warehouseman, of Warrington, who was killed while working an electric lift at Messrs. Rylands Bros., on March 12th. Dr. Binns, who had made a post-mortem examination, said he could not say for certain that the man had died from electric shock. The Coroner pointed out that at the last sitting a witness had said that Morris took hold of the handle of the lift; there was a flash, and then he was seen lying on the floor. Mr. Brown, H.M. Divisional Electrical Inspector of Factories, said that a piece of insulating material had been left out of the lock of the lift gate, and a regulation referring to the working of electric lifts had been broken. It was probable that the accident would not have happened if the regulations had been carried out. The Coroner found that death was due to "electrocution," and said he did not think that anyone was criminally to blame for the negligence.

National Trades Exhibition.—The Lord Mayor of Birmingham (Alderman T. O. Williams) formally opened the 22nd annual trades exhibition at Bingley Hall on March 17th. There are over 200 trade exhibits, and in the main they deal with the requirements of the home. As in previous years, 5 per cent. of the gross admission money is to be given by the promoters to the Queen's Hospital, Birmingham, and over £4,000 has already been added to the funds of that institution through this channel. The Birmingham Corporation Electric Supply Department is responsible for a well-arranged exhibit in the form of an "all-electric" house.

The British Association.—It is announced that Dr. Horace Lamb, F.R.S., formerly Professor of Mathematics at the Manchester University, is to be nominated by the Council as president for the Southampton meeting next year.

United States Government's Action Against Lamp Manufacturers.—The New York correspondent of *The Times* states that the Government, on March 20th, brought an action in the Federal Court of Cleveland, Ohio, against the General Electric Co., the Westinghouse Electric & Manufacturing Co., and the Westinghouse Lamp Co., charging them with conspiracy in restraint of trade. The Government's charge was based upon the system of contracts employed by defendants in distributing incandescent lamps. According to the petition, the General Electric Co.'s control of the patents for the exclusive manufacture of tungsten filaments used in electric lamps vests in it a virtual monopoly of the manufacture and sale of such lamps. The General Electric Co. issued a statement to-day asserting that its methods of sale had stood the test of actions in Court and had been found unobjectionable by the Federal Trade Commission after an investigation in 1920.

Electricity at the Shoe and Leather Exhibition.—Electricity for driving machinery received an excellent advertisement at the recent Leicester Shoe and Leather Exhibition. Both group and individual drives were employed, and there was over 8,000 ft. of machinery, all of which was driven electrically. Among the shoe-making and leather-working machines driven by electric motors were sewing machines, heel cutters and scourers, fore-part parers, perforating machines, looms for weaving linings, brushes, pads, &c. All the motors were made by Bull Motors, Ltd., Stowmarket, and they were installed, with the rest of the electrical work, by that company's Leicester agents, the Midland Dynamo Co., Ltd. The



Electrically-driven Machines at the Shoe and Leather Exhibition.

starters were supplied by the Electrical Apparatus Co., Ltd. A feature of the show was the extensive use of chain drives between the motors and machines. The benefits to be obtained from this method of drive, in conjunction with an electric motor, can be gauged from the illustration accompanying this note. The motor is stowed away beneath the bench, and the chain passes from the spur wheel on the motor shaft to a larger wheel driving a shaft which serves a line of machines, forming a very compact, out-of-the-way system. The chain is shown without a case or an oil bath, but in actual use it is customary to provide both.

Electricians' Wages.—In accordance with the terms of settlement adopted by the National Council for the Electricity Supply Industry, on November 4th, 1920, the next wages revision should take place as from April 1st, but the average of the cost of living figures for January, February, and March is 78 per cent., which, if deducted from the datum figure of 120, leaves 42, or seven blocks of six complete points; as there have been seven variations (net) to date, there will therefore be no change.

Another Diesel-Electric Ship.—Messrs. Cammell, Laird and Co., launched on March 22nd, at their Birkenhead yard, the *La Perla*, which is the last of three sister Diesel-electrically-driven vessels for the United Fruit Co., of Boston, U.S.A.—*Financial Times.*

National Debt Inquiry.—A committee has been appointed by the Chancellor of the Exchequer to inquire into the National Debt. The committee is constituted as follows:—Lord Colwyn (chairman), Sir Charles Addis, Sir Alan Anderson, Sir Arthur Balfour, Mr. Henry Bell, Mr. J. W. Bowen, Mr. Fred Bramley, Mr. W. L. Hichens, Mr. J. A. Hobson, Mr. H. B. Lees-Smith, Sir William McLintock, Sir Josiah Stamp, and Mrs. Barbara Wootton. Mr. W. L. Hichens is deputy-chairman of the English Electric Co., Ltd., a director of the London, Midland and Scottish Railway, and the chairman of Cammell, Laird & Co. He has held a number of official posts of a financial nature.

Late Legal.—BRITISH THOMSON-HOUSTON CO., LTD., *v.* CHARLESWORTH, PEEBLES & CO.—As foreshadowed in our last issue, an appeal has been lodged by the defenders in the House of Lords. The respondents have been ordered to present a printed case in answer on or before May 5th.

Quorum pars magna—non fuit!—A new rule that was to be adopted, with others, at a meeting of the contributors to the Benevolent Fund of the Institution of Electrical Engineers yesterday is touching in its delightful naiveté. It reads as follows:—"The presence of at least five contributors shall be necessary for the transaction of business at a general meeting, and if that number be not present within a quarter of an hour from the time appointed, the presence of at least three contributors shall be sufficient to constitute the meeting." Under the old rule, a general meeting had to be adjourned unless five contributors were present. And now—what is a quorum?

The American Electrochemical Society.—The spring meeting of the American Electrochemical Society is to be held in Philadelphia on April 24th, 25th, and 26th. The technical meeting will be devoted to a symposium on "Organic Electrochemistry." Dr. C. J. Thatcher, chemical engineer and electrochemist, of New York City, will act as chairman. The discussion will cover the applications of electrochemistry in the preparation of organic chemicals, both in the U.S.A. and abroad, and in particular the future possibilities for the commercial production of such compounds. The other symposium covers "Recent Progress in Electro-deposition." Mr. S. Skowronski, research chemist of the Raritan Copper Co., will be chairman. A series of very interesting papers has been planned, covering the electro-refining, electro-reduction, electro-forming, and electro-plating of metals.

In the United States electrolytic zinc from leached solutions is being produced at the rate of 200 tons a day. A plant in Canada is turning out commercially, not only electrolytic zinc, but electrolytic copper and lead. Marked improvements have been made in the electro-refining of lead. A process which has attracted world-wide attention is the leaching of pyrrhotite with ferric chloride solution, producing a solution of ferrous chloride and at the same time throwing out sulphur in the elemental state. This process is being carried out commercially in France; the ferrous chloride solution is electrolysed, and seamless iron tubes are electrodeposited on mandrels, using insoluble anodes. The spent electrolyte passes over fresh quantities of pyrrhotite. Within the last few years the electrolytic refining of tin has gone through very important stages. Originally, the electrolyte was the fluosilicate bath. This has now been dispensed with, and the simple tin sulphate bath is used. Large quantities of cadmium are now produced cheaply as a by-product of the electro-refining processes, particularly that for zinc, and cadmium has become an important metal for protecting steel from corrosion. Three plants in the United States are devoting their entire energies to the electrodeposition of cadmium. Cadmium is also used now, to some extent, as an addition to the silver bath in producing a silver deposit which does not tarnish and is not affected by hydrogen sulphite. Improvements in the electrolytic nickel process have also been made. The technical programme will also include a discussion on "Electric Furnace Refractories," and there will be several interesting papers presented dealing with various phases of the subject.

Educational.—SCHOLARSHIPS IN ELECTRICAL ENGINEERING.—The British Electrical and Allied Manufacturers' Association directs attention to the fact that it grants annually, to properly qualified candidates of British birth engaged in engineering works, ten scholarships (each of the value of £100) in addition to the payment of college fees. The last date for the receipt of applications is June 1st. Form of application and full particulars may be obtained by writing to the Secretary, B.E.A.M.A., 36, Kingsway, London, W.C.2.

Engineering Institutions in Ireland.—Mr. Laurence J. Kettle, M.I.E.E., writing in the March issue of *Irish Engineering*, draws attention to the large number of engineering institutions at present existing in Ireland. He considers that the position is absurd, and advocates one institution to embrace all classes of engineers, with separate sections for electrical and mechanical engineers if this is thought desirable. The principal difficulty in the way of such a scheme is said to be that the Institution of Civil Engineers of Ireland, the largest Irish institution, would be unwilling to accept as members those who are already members of the sister institutions. Mr. Kettle also thinks that Irish members of the English institutions would be loth to sever their connection with them.

Appointments Vacant.—Plumber-jointer for the Southend-on-Sea Corporation Electricity Department; plumber-jointer for Lancaster Corporation Electricity Works; consumers' engineer, £327, for the Southampton Corporation Electricity Department; chief engineer and manager, £700, for the Government of the Tanganyika Territory, electricity department; oil engine inspector (750 Rs. per mensem) for the Government of India; plumber-jointer for the Peterborough Corporation Electricity Department; assistant mains engineer (400 dollars per month, dollar = 2s. 4d.) for the Municipality of George Town, Penang, electricity supply and tramway department; assistant distributing engineer for the Preston Corporation Electricity Department; plumber-jointer for the Stepney Borough Council Electricity Department. (See our advertisement pages to-day.)

Dinner.—The No. 4 (Newhaven) Company, L.E.E., R.E. (T.), will be holding their annual reunion and dinner at the Florence Restaurant, W., on Saturday, April 12th. Old members are asked to communicate with Mr. A. E. Beach, Shawfield Street, Chelsea, S.W.3.

The Society of Technical Engineers.—Pressure is being exerted on the Government from various quarters to revive the plan put forward by Mr. Lloyd George in 1919, while he was Prime Minister, for a National Industrial Conference to consider possible means of avoiding industrial disputes. It may be remembered that when the plan was first mooted no place was provided under it for the representation of professional staff workers or their organisations. The Society of Technical Engineers intervened then to remedy this defect. It has again taken action now with a view to securing representation for its members if the Government decides to go on with the matter. Manual workers' trade unions have not hitherto been sympathetic to the separate representation of staff workers, but it is felt that the time has come when their attitude in this respect must be modified. It will be interesting to see how the Labour Government deals with the question; it has been asked to receive a deputation on the subject. The S.T.E. does not wish to interfere in any way as between employers and manual workers, but it is pressing for the right to be heard on behalf of technical staffs in the engineering industry, whose interests have been too long overlooked.

To-day (Friday) a meeting is to be held under the auspices of the newly-formed National Council of Technical Staff Associations (of which particulars were given in our issue of March 14th), at Manchester. Mr. C. H. Wordingham, C.B.E., will preside, and Messrs. R. Hazelton and A. L. Lunn will speak on the aims of the Council. Writing to the secretary of the Society of Technical Engineers on the subject of the meeting, Sir Robert Hadfield expresses his wishes for its success, and suggests that particulars regarding the very laudable aims of the National Council should be forwarded to the councils of the leading institutions, which could be counted upon to give them a fair hearing. Sir Robert concludes with an expression of his "sympathy with the object of those who are trying to improve themselves, and make the line of work in which they are engaged more useful for the general benefit of our Empire."

Local Societies.—CONDENSERS.—Mr. P. R. Coursey, B.Sc., F.Inst.P., A.M.I.E.E., president of the Radio Society of Highgate, gave a lantern lecture on March 21st, his subject being "Modern Condensers and their Manufacture." After dealing briefly with the theory of the action of a condenser, Mr. Coursey indicated the difficulties met with in designing condensers with a high power-factor to withstand high pressures. Some interesting slides were shown indicating the working of a mica mine, and the transport of the raw material to the Dubilier Condenser Co.'s works at Shepherd's Bush. The assembly of the small condensers used in radio receivers, and the manufacture of gridleaks and anode resistances were followed step by step, special mention being made of the very thorough tests to which every condenser and resistance is subjected before leaving the works. The manufacture of various types of large condensers was then dealt with, and it was stated that the efficiency of these condensers exceeded 99.99 per cent. Mr. Coursey concluded his instructive lecture by showing a few slides of the experimental transmitting station, 6XX, of the Radio Society of Great Britain.

OVERHEAD TRANSMISSION LINES.—Mr. G. N. Holmes read a paper on "The Construction of Overhead Lines for Electrical Transmission" to the West of Scotland Branch of the Association of Mining Electrical Engineers, on March 19th, at Glasgow. The paper dealt with the application of overhead transmission to industrial plant, such as collieries and ironworks. Having discussed their design, Mr. Holmes dealt with the relative advantages of copper and aluminium conductors. Keen interest was shown in an analysis of the different stresses to which the structures are subject.

BROADCASTING.—At a meeting of the Edinburgh Electrical Society, held on March 21st, Captain N. Turner delivered a lecture upon "Wireless Broadcasting." The lecture opened with a description of the studio and transmitting apparatus of the Glasgow station, afterwards dealing with the thermionic valve and its various application to wireless telephony. The lecturer advocated single aerials in preference to double, the former having the advantage of greater selectivity and being less unsightly.

Institution Notes.

Institution of Electrical Engineers.—INFORMAL MEETING.—At a meeting of the Informal Section, on March 16th, Mr. A. F. Harmer was in the chair when Messrs. L. Gaster and J. S. Dow opened a discussion on "Illuminating Engineering." Mr. Gaster contributed the historical, the research, and the anecdotal side of the paper, while Mr. Dow exhibited and explained a series of very interesting slides, showing the application of illuminants to various needs. The public, he said, must be educated, and if legislation be attempted for the compulsory provision of adequate lighting, they must see that the minimum standard of lighting was high, because it would inevitably become the only standard. Mr. Gaster was severe on exaggerated lighting in the form of glare. He also deplored the lighting conditions of many public railway stations, their approaches, carriages, &c. He advocated that electrical engineering courses at technical colleges should instruct in the correct application and use of light. Mr. W. E. Bush said that a good deal of blame rested on the industry for faulty presentation of the case for good lighting. Mr. J. Coxon pointed out that a standard of illumination must depend, not only on the source and degree of light, but also on the class of work to be done. The counter-weight pendant, with the power to pull a light right down on the writing pad, was often grossly misused.

Mr. J. Eck agreed that co-operation with medical and health authorities was important because people suspected that one was after profit if one recommended improvements that cost money. Messrs. J. R. Bedford, A. Cunnington, W. Day, P. Dunsheath, O.B.E., W. P. Fanghanel, P. Good, A. F. Harmer, and E. W. H. Wilson also spoke.

JOINT MEETING.—At the joint meeting, on March 20th, in connection with the jubilee celebrations of the Physical Society of London, Sir Richard Paget, Bart., delivered a lecture upon the "Nature of Speech," in the course of which he demonstrated that each of the whispered vowel sounds comprises two characteristic audible resonant components. Each of the latter may vary over a range of a few semitones, and the upper and lower components are separated in the case of different vowels by intervals of from about 36 to 6 semitones. The voiced vowels are produced by the passage of vibrating air (from the larynx) through the oral cavity when adjusted to give the approximate pair of resonances. The lecturer exhibited and demonstrated his plasticine models for reproducing vowel sounds (including an electrical resonator devised by Dr. W. H. Eccles); the devices consist, in their simplest form, of pairs of resonators tuned to the tones characteristic of various vowels and so arranged that the sound from an artificial larynx (or squeaker) can be passed through them in series or in parallel. Certain vowels, in which the upper resonance is a harmonic of the lower, can also be produced by means of a single resonator. In illustration, the lecturer arranged his hands to form a double resonator in imitation of the human mouth, and passed through them the sound from a squeaker representing the larynx; by manipulating his fingers and hands and varying the air passing through the squeaker, he was able to make this hand-operated talking machine, or "cheirophone," pronounce the vowel sounds and some simple sentences.

BENEVOLENT FUND.—An extraordinary general meeting of the contributors to the benevolent fund was to be held on March 27th, pursuant to rules 21 and 26 of the rules of the fund, for the purpose of considering and, if thought fit, approving and adopting new rules for the furtherance of the object of the fund. The draft rules prepared by the Committee of Management for the foregoing purposes will be submitted for confirmation to a further extraordinary general meeting of contributors to the fund which will be held on May 8th, at 5.30 p.m.

WESTERN CENTRE.—Dr. Alexander Russell, M.A., D.Sc., F.R.S., president of the Institution, addressed the members of the Western Centre, at Cardiff, on March 17th, Mr. C. T. Allan, chairman of the Centre, presiding. Dr. Russell considered the outlook of the electrical industry during the coming year very promising. If this country was to maintain its place amongst civilised nations, it must not only produce many inventions, but must have works ready to develop them at once. In pre-war days the discoveries of British scientists were often first commercially developed in Germany. Electrical science had begun a new life, and, seemingly, a most vigorous one, based on the recognition of the two electrical atoms, the electron and the proton. Research work was making rapid progress in this country, but they were still a long way behind the vast amount of research that was being done in America. In radio-communication they were on the threshold of an almost miraculous linking up of the whole world by electrical reproduction of sound. Electrical engineers were on the track of methods of eliminating the trouble caused by atmospherics. In conclusion, Dr. Russell gave the following advice to the younger members of his audience:—"Some of you will play an important part in the coming revolutionary changes in engineering practice. It is meet, therefore, that you equip yourselves to the best of your ability with those theoretical tools which are becoming more and more necessary, the more refined, the more difficult, and the more abstruse the problems become which have to be solved. May you all acquit yourselves like men, and with the illuminating torch of science make natural forces more and more the servants of humanity."

Subsequently the members assembled at dinner at the Royal Hotel, Mr. C. T. Allan presiding. In proposing the toast of "The Institution of Electrical Engineers," Mr. W. A. Chamen referred to the enormous application of electricity in mines and elsewhere, and said that it was gratifying to find that, despite the many uses made of electricity in the mines of South Wales, no fatal accidents occurred in connection with its use last year. Replying, Dr. Russell spoke in high terms of the Western Centre, and added that

the membership of the Institution exceeded 11,500. They were looking forward to their meetings at the British Empire Exhibition at Wembley, at which the Kelvin Medal was to be presented to Prof. Elihu Thomson.

Institution of Civil Engineers.—HEAT ENGINE AND BOILER TRIALS.—In September, 1922, the Institution of Civil Engineers invited seven other institutions to co-operate in the revision of the 1913 Code of boiler and engine tests, and in the establishment of a code for internal-combustion engines, and for this purpose a committee was formed to which the eight institutions have nominated four members each, while, in addition, there are representatives of the B.E.A.M.A. and of the British Engineers' Association. The membership of the Committee has been carefully chosen so as to include experts in the various departments of the inquiry, as well as the users and makers of all the various kinds of heat engines. The Main Committee is divided into sub-committees and panels which are empowered to co-opt members to obtain advice on any special point.

The tabulated forms required for a "comprehensive" test of the respective types of heat engines are now nearly completed. Selected items have been abstracted to produce short forms suitable for "commercial" tests. It is proposed to print separate forms, both for "comprehensive" and "commercial" trials for boilers, gas producers, and the various heat engines. The next stage in the work will be the preparation of an appendix giving suitable methods for making the various measurements, and of another appendix setting out the calculations required to arrive at the conclusions derived from the data obtained by observation. Separate appendices will be prepared for "comprehensive" and for "commercial" trials.

In due course it is proposed to submit various items for discussion to the particular institution or institutions most interested in the items in question. In this way it is hoped that the final findings of the Committee will embody the views of all those interested in the testing of heat engines.

The Committee is in close touch with the corresponding Committee of the American Society of Mechanical Engineers.

The Physical Society of London.—JUBILEE CELEBRATION.—On Thursday, Friday, and Saturday last week the jubilee of the Physical Society was celebrated at the Institution of Electrical Engineers, in accordance with the programme already summarised. Mr. F. E. Smith, C.B.E., F.R.S., president of the Society, presided at the opening meeting, and reviewed the history of the Society, which was founded by Prof. F. Guthrie, and began with a membership of 99 Fellows, now increased to 600. Addresses of congratulation were presented by delegates from kindred societies at home and abroad, and the Guthrie lecture was delivered by the Duc de Broglie, on the photo-electric effect. In the evening Sir Richard Paget gave a most interesting lecture (summarised on the previous page) to a joint meeting of the Society and the Institution of Electrical Engineers.

On Friday, Sir William Barrett, F.R.S., told the story of the foundation of the Society, and Prof. J. A. Fleming, F.R.S., reviewed the progress of physical science during the half-century. Prof. C. V. Boys, F.R.S., who was to have spoken, was unfortunately unable to attend owing to illness. Sir Richard Glazebrook, F.R.S., gave a discourse on "Electrical Measurements." In the evening Prof. H. E. Armstrong, Sir Arthur Schuster, and Dr. C. Chree gave addresses, and Sir Oliver Lodge discussed "Our Present Position as Regards Ether," which, he held, had not been rendered a superfluous assumption by modern theories. On Saturday the celebration concluded with a banquet, the proceedings at which are reported elsewhere in this issue.

An exhibition of apparatus of historical interest, most of which had been shown first at meetings of the Society, and of modern developments from these early patterns, was held during the three days, and special demonstrations were given at intervals.

Radium Institute.—With the approval of the King, Sir Anthony Bowlby has been elected chairman of the Radium Institute, in place of the late Sir Malcolm Morris. Sir George Blacker has been elected a member of the Committee.—*The Times.*

Institution of Engineers-in-Charge.—We have received copies of the Institution's *Transactions*, one of which (the October, 1923, issue) contains information regarding the incorporation of the Institution and its change of title. This includes a full transcript of the memorandum of association. The November issue contains a report of the proceedings at the meeting at which Mr. T. Cooper, M.A., was inducted president of the Institution, together with the address which he delivered on that occasion, "Engineering Records and their Value to the Engineer-in-Charge." Among a number of interesting papers reproduced is one in the October journal by Mr. A. Arnold, A.M.I.Mech.E., on "The Choice of Power Plants."

N.E. Coast Institution of Engineers and Shipbuilders.—The Institution has decided, in conjunction with the Institution of Naval Architects, to hold a summer meeting in London from June 24th to 28th, and a preliminary programme has been issued. This includes a visit to the British Empire Exhibition, and the inspection of docks and shipping, and after the London function there will be visits to Glasgow and Newcastle.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Mr. PERCY FURNESS, A.M.I.E.E., has resigned his position as sales engineer to the Yorkshire Electric Power Co. to take an appointment in South Africa with Messrs. Merz and McLellan, consulting engineers.

The members of the Electrical and Telegraph Engineers' Conference entertained Mr. ANDREW F. ROCK, M.I.E.E., to dinner at the Midland Grand Hotel on March 18th, on his retirement from the secretaryship of the Conference (which he has held during the past eight years), and presented him with a silver coffee set. The company included Sir William Noble, Colonel T. Purves, Mr. Sinnott, Captain R. Terrell, M.P., Mr. H. Hirst, Dr. Railing, Mr. Hardy Parsons, Mr. Roger T. Smith, Lieut.-Colonel Cortez Leigh, Mr. C. M. Jacobs, and Mr. C. W. Neele; the president of the Conference, Mr. W. J. Thorrowgood, was in the chair.

In connection with the vacancy caused by the retirement of Mr. FRANK A. NEWINGTON, engineer and manager of the Edinburgh Corporation Electricity Department, the appointment is recommended of Mr. E. SEDDON, the chief assistant engineer.

It is announced that Mr. GERALD T. MOODY has joined the board of the Isle of Thanet Electric Tramways & Lighting Co., Ltd.

Douglas (Isle of Man) Town Council is recommended to increase the salary of the Borough Electrical Engineer, Mr. B. KELLY, from £417 to £470 per annum.

Mr. C. GORDON HUNTLEY, A.M.I.E.E., M.I.H.V.E., has relinquished his connection with the consulting engineering practice of Messrs. Huntley & Wood, and has joined the technical staff at the London office of Messrs. Davidson and Co., Ltd., Central House, Kingsway, W.C.2.

Mr. LESLIE G. TOPLIS, who has represented the interests of Messrs. Veritys, Ltd., in Glasgow for the past 10 years, is leaving that company at the end of March and joining the Linfield Cable Works, Ltd., to attend to their Scottish business. He will continue to be resident in Glasgow.

Mr. W. H. DAVIES has left Messrs. Siemens & English Electric Lamp Co., Ltd., which he represented in the Eastern Counties, and has joined the staff of Messrs. Pritchetts & Gold and E.P.S. Co., Ltd., to cover the same area.

Obituary.—DR. W. H. MAW.—It is with deep regret that we have to record the death of one of the foremost figures in British engineering journalism—Dr. William Henry Maw,

Thos. Fall] [*London.*

THE LATE DR. W. H. MAW, LL.D.

LL.D.—which occurred suddenly on March 19th at his residence at Kensington in his 86th year. Dr. Maw, who was born at Scarborough, was apprenticed at the Eastern Counties

Railway Works (now the Great Eastern Works) at Stratford. At the age of 27 (that was in 1865) he left the Great Eastern Railway to join the late Mr. Zerah Colburn in the establishment of *Engineering*, and the two jointly edited and managed the paper for some years. Early in 1870 Mr. Colburn ceased to be connected with *Engineering*, and Dr. Maw was joined in the editorship by the late Mr. James Dredge, who had also been associated with the paper since its foundation. Until the death of Mr. Dredge in 1906, *Engineering* was carried on under their joint editorship, and since then Dr. Maw had continued as senior joint editor with Sir Alexander Richardson. From 1870 until within a few years ago Dr. Maw also had an independent practice as a consulting engineer, his work being largely in connection with engine and boiler construction and the design and arrangement of workshops and similar buildings. He took particular pleasure in the laying-out of printing works for a number of important newspapers. He was, of course, a writer on a very wide range of engineering subjects, and was closely interested in the doings of all societies and institutions connected with the profession and industry, but the institution which profited most by his work was the Institution of Mechanical Engineers, of which he became a member in 1873, served for thirty years continuously on the Council, and was president on two successive occasions. In 1896 he joined the Institution of Civil Engineers, and in the following year delivered the James Forrest Lecture, giving a close analysis of some of the engineering problems that remained to be solved. He was president of the Civils in 1922, and his address was a sequel to the James Forrest Lecture; in it he showed the progress that had been made toward the solution of the unsolved problems referred to in that lecture. He did much to encourage scientific research and did excellent work for the British Engineering Standards Association. He was almost as well known for his work in astronomy as for that in engineering. Space fails us to do full justice to the achievements that lie to his credit during an unusually lengthy life in a position of exceptional authority and power in the engineering and scientific world.

MR. H. DEANE.—We regret to note from *The Times* that the death occurred, on March 12th, at Melbourne, Australia, of Mr. Henry Deane, M.A., M.Inst.C.E., formerly engineer-in-chief for railways, N.S. Wales, and consulting engineer to the Australian Commonwealth.

MR. E. HUMPHRIES.—The death has taken place at Buckfastleigh, Devon, at the age of 44 years, of Mr. Edward Humphries, electrical engineer. He was manager of the Blockley Electric Supply Co., and also of the electrical works of Messrs. Heath, at Buckfastleigh.

New Companies Registered.

Charles Gates, Ltd. (196,471).—Private company. Registered March 18th. Capital, £2,000 in £1 shares. To take over the business of an electrical engineer and dealer in electrical plant and accessories, carried on by Charles Gates, at 29, St. Giles Street, Norwich, and to carry on the same and the business of manufacturers of and dealers in wireless apparatus, optical and other instruments, &c. The permanent directors are:—G. L. Lang, Great Plumstead Hall, Norwich, gentleman farmer; C. Gates, 29, St. Giles Street, Norwich, electrical engineer. Qualification, £100. Secretary: D. V. Hayden. Registered office: 29, St. Giles Street, Norwich.

Albert Electrical Co., Ltd. (196,350).—Private company. Registered March 13th. Capital £100 in £1 shares. To carry on the business of electricians, electrical and mechanical engineers, machinists, wire drawers, manufacturers and repairers and brokers of, agents for and dealers in all kinds of electrical apparatus, materials and accessories, &c. The first directors are:—Miss M. Middleton, 73, Gaythorpe Street, Moss Side, Manchester; A. E. Outhwaite, 8, Derby Avenue, Weaste, Salford (both partners in the Albert Electrical Co.). A. E. Outhwaite signs as managing director. Qualification, £1. Registered office: 16, Albert Square, Manchester.

A. C. Hodson, Ltd. (196,433).—Private company. Registered March 17th. Capital, £3,000 in £1 shares. To carry on the business of electrical, mechanical and general engineers, manufacturers of and dealers in electrical apparatus and fittings, &c. The first directors are:—T. Hartley, 92, Glen View Road, Burnley, cotton manufacturer; W. Holroyd, 29, Devonshire Road, Blackpool, cloth agent. Qualification, 100 shares. Secretary: T. Hartley. Registered office: 30, Spring Gardens, Manchester.

G. Gilliver & Co., Ltd. (196,438).—Private company. Registered March 17th. Capital, £1,000 in £1 shares (500 "A" ordinary and 500 "B" ordinary). To carry on the business of electrical engineers, manufacturers of and dealers in electrical machines, wireless apparatus, motors and appliances, &c. The first directors are:—G. Gilliver, 44, Lorrimore Road, S.E.17, electrical engineer; H. A. King, 7, Cyprus Avenue, Finchley, N.W., company director (chairman) (both permanent, subject to holding 450 ordinary "B" and 450 ordinary "A" shares respectively). G. Gilliver is works manager. Solicitors: J. and M. Solomon, 58, Finsbury Pavement, E.C. Registered office: 6, Panyer Alley, Paternoster Row, E.C.4.

Freshwater and District Electric Supply Co., Ltd. (196,422).—Registered March 15th. Capital, £20,000 in £1 shares. To adopt agreements (1), dated March 10th, with Edmundson's Electricity Corporation, Ltd.; and (2), dated March 11th, with Isle of Wight Electric Light and Power Co., Ltd., and to carry on at Freshwater, Totland and elsewhere in the Isle of Wight or the U.K. the business of an electricity supply company in all its branches. Minimum cash subscription, £16,000. The first directors are:—The Rt. Hon. John E. B. Seeley, C.B., C.M.G., D.S.O., M.P., Brooke House, Isle of Wight, Privy Councillor; Brig.-General Philip Leveson-Gower, C.M.G., D.S.O., Kings, Freshwater, Isle of Wight; A. N. Rye, M.I.E.E., 6, Eton House, Belsize Park Gardens, N.W.; Lt.-Col. Arthur E. Mayes, T.D., M.I.E.E., Camperdown, Alpine Road, Ventnor, Isle of Wight. Qualification, £50 shares. Remuneration as fixed by the company, but none shall be paid in the event of a dividend under 5 per cent. being declared. Solicitors: Stratton, 31, Pyle Street, Newport, Isle of Wight. Registered office: Electricity Works, Ventnor, Isle of Wight.

P.S. Wireless Manufacturing Co., Ltd. (196,372).—Private company. Registered March 13th. Capital, £2,000 in £1 shares. To carry on the business of manufacturers of wireless receiving instruments and any parts thereof, &c. The first directors are:—J. T. Petro, The Manor House, Davies Street, Berkeley Square, W., stockbroker; J. A. W. Petro, Bilsborough, Henfield, Sussex, farmer; H. L. Smith, 94, Hollingbury Park Road, Brighton, engineer; J. C. Thornton, 24, Ship Street, Brighton, solicitor's articled clerk. Qualification, £10. Remuneration as fixed by the company. Solicitors: A. A. H. Hardwick and Blaber, 24, Ship Street, Brighton. Registered office: 24, Ship Street, Brighton.

Interchangeable Electric Signs, Ltd. (196,331).—Private company. Registered March 12th. Capital, £2,500 in £1 shares. To carry on the business of manufacturers and suppliers of interchangeable electric signs, &c., and to adopt two agreements with C. K. Roylance. The permanent directors are:—G. Harvey, J.P. (chairman), address not stated; P. G. A. Harvey, 16, Rosary Gardens, S.W.7; J. S. Stevenson, address not stated; H. D. Hardwicke, address not stated; C. K. Roylance, 6, Clifton Avenue, Belmont, Surrey. Qualification, £100. Remuneration, £250 per annum divided between them. Solicitors: Few & Co., 19, Surrey Street, Strand, W.C.2. Registered office: 15, Caxton House, Westminster, S.W.1.

N. and K. Wireless Headphone Distributing Co., Ltd. (196,426).—Private company. Registered March 15th. Capital, £500 in £1 shares. To adopt an agreement with M. Woolf and to carry on the business of manufacturers, importers and exporters of and dealers in electrical and wireless appliances and apparatus, &c. The first directors are:—M. Woolf, Agar House, Chandos Street, W.C.2, merchant (managing and permanent director); A. James, Bracondale, Wrotham Road, near Gravesend, merchant. Registered office: Maxwell House, Arundel Street, Strand, W.C.2.

Henry R. Leveson & Co., Ltd. (196,513).—Private company. Registered March 19th. Capital, £2,500 in £1 shares. To acquire the business of electrical engineers and contractors now carried on by J. Cunningham and E. Busfield as "Henry R. Leveson & Co." at 95, Park Lane, Leeds. The first directors are:—J. Cuningham, Lord Nelson, Crigglestone, near Wakefield, electrical engineer; E. Busfield, 80, Holdforth Street, New Wortley, Leeds, electrical engineer; A. B. Johnson, 11, Hawkswood Grove, Kirkstall, Leeds, electrical engineer (all permanent, subject to each holding 500 shares). Registered office: 95, Park Lane, Leeds.

Fylde Electric Co., Ltd. (196,423).—Private company. Registered March 15th. Capital, £2,000 in £1 shares. To enter into a contract (1) with A. T. Entwistle for the acquisition of the business of an electrical engineer carried on by him at Beechfield Works, Whitegate Drive; and (2) with T. Turvey for the acquisition of a similar business carried on by him at Church Street, both in Blackpool. The first directors are:—A. T. Entwistle, 88, Cunliffe Road, Blackpool, electrical engineer; T. Turvey, 80, Loftus Avenue, S.S. Blackpool, electrical engineer. Qualification, 250 shares. Remuneration as fixed by the company. Solicitors: E. G. Booth, 14, Brown Street, Manchester. Registered office: Grove Chambers, Leopold Grove, Blackpool.

City Fuseboard Co., Ltd. (196,437).—Private company. Registered March 17th. Capital, £2,000 in £1 shares. To acquire the business carried on by A. E. Follows at Fountain Works, Lennox Street, Birmingham, as "Follows Wright and Co." and the "City Fuseboard Co.," and to carry on the business of fuseboard makers, electricians, electrical engineers, &c. The first directors are:—A. E. Follows, 29, Clifton Road, Aston, Birmingham, manufacturer (permanent managing director); Mrs. M. E. Follows, 29, Clifton Road, Aston, Birmingham. Solicitors: Hatwell, Pritchett and Co., 55, Temple Row, Birmingham. Registered office: Fountain Works, Lennox Street, Birmingham.

Constant Potential Transformer Syndicate, Ltd. (196,379).—Private company. Registered March 14th. Capital, £6,000 in £1 shares (3,000 6 per cent. participating preference and 3,000 ordinary). The balance remaining after paying the preference dividend in each year is to be distributed as to 40 per cent. on the preference shares and as to 60 per cent. on the ordinary shares. To acquire the property and assets of G. E. Adams and Co., Ltd.; to finance inventors for the purpose of enabling them to test and perfect their inventions; to carry on business as founders, electrical, mechanical and general engineers, manufacturers of machinery, &c. The first directors are:—E. Young, 4, Gainsborough Gardens, N.W.3, stockbroker; S. Lancaster, 25, Park Road, Clarence Gate, N.W., silk merchant. Qualification, 50 shares. Remuneration, 5 per cent. of the net profits, divided between them. Acting secretary: J. E. Young. Solicitors: F. C. Mathews and Co., 110, Cannon Street, E.C.4. Registered office: 110, Cannon Street, E.C.4.

Austin Brothers Electrical Co., Ltd. (196,371).—Private company. Registered March 13th. Capital, £1,000 in £1 shares (300 7 per cent. cumulative preference and 700 ordinary). To carry on the business of electricians, electrical and mechanical engineers, merchants, manufacturers, contractors, carriers, dealers in electrical, magnetic, telephonic, telegraphic, and other appliances and apparatus, &c. The first directors are:—T. J. Penney, 24, Little Ilford Lane, Manor Park, E.12, electrical engineer; R. W. Austin, 26, Ulleswater Road, Southgate, N.14, electrical engineer; J. H. Turtle, address not stated. The two first named are permanent. Qualification, £1. Remuneration, £12 each per annum. Secretary: May Ranson, 254, Monega Road, Manor Park, E.12. Solicitors: Kingsley Wood, Williams & Co., 15, Walbrook, E.C.4.

Official Returns of Electrical Companies.

A. J. Bennett & Weaver, Ltd.—R. Stephens, of 31, Lombard Street, E.C., was appointed receiver and manager on March 13th, 1924, under powers contained in debenture dated June 11th, 1923.

Thompson Manufacturing Co., Ltd.—Debenture dated March 10th, 1924, to secure £175, charged on stock in trade, goodwill, book debts, undertaking and other property, present and future, including uncalled capital. Holders: Fellows Magneto Co., Ltd., Cumberland Avenue, Park Road, Willesden, N.W.

Atkinson Lloyd & Co., Ltd.—Particulars filed of £600 debentures authorised February 12th, 1924, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £400.

Rangoon Electric Tramway and Supply Co., Ltd.—Trust deed created outside the U.K. dated January 25th, 1924 (supplemental to trust deeds dated February 1st, 1906, December 22nd, 1908, November 5th, 1913, and October 7th, 1914, securing £250,000 debenture stock), charged on all the property charged by the original three supplemental deeds, except certain leases. Trustees: Sir Arthur N. Hill, 10, Water Street, Liverpool; and J. W. W. Danson, Minera Hall, Wrexham.

East Anglian Electricity, Ltd.—Satisfaction in full on February 29th, 1924, of debentures dated December 28th, 1923, securing £1,000.

Bath Electric Tramways, Ltd.—Satisfaction in full on August 12th, 1919 (a) of second mortgage debentures dated March 6th, 1906, and March 26th, 1907, securing £16,000; and (b) of "A" mortgage debentures dated March 26th, 1907, securing £8,000. (Notices filed March 14th, 1924.)

W. G. Cannon & Sons, Ltd. (87,796).—Return dated December 31st, 1923. Capital, £3,000 in £1 shares. All shares taken up. £9 paid. £2,991 considered as paid. Mortgages and charges, nil.

Marconi's Wireless Telegraph Co., Ltd. (53,403).—Return dated December 17th, 1923. Capital, £4,000,000 in 3,750,000 ordinary and 250,000 7 per cent. cumulative participating preference shares of £1 each. 2,750,065 ordinary and 250,000 preference shares taken up. £2,884,040 paid on 2,634,040 ordinary and 250,000 preference shares. £116,025 considered as paid on 116,025 ordinary shares. Mortgages and charges, £1,505,411 12s. 4d.

Provincial Tramways Co., Ltd. (6,445).—Return dated January 11th, 1924. Capital, £275,440 in 10,000 preference shares of £10 each and 175,440 ordinary shares of £1 each. 10,000 preference and 124,560 ordinary shares taken up. £162,700 paid on 3,814 preference and 124,560 ordinary shares. £61,860 considered as paid on 6,186 preference shares. Mortgages and charges, £175,000.

Suppliers Construction Co., Ltd. (66,081).—Return dated December 19th, 1923. Capital, £350,000 in £5 shares. All shares taken up. £350,000 paid. Mortgages and charges, nil.

Cutting Bros., Ltd.—Satisfaction in full on March 15th, 1924, of debentures dated February 14th, 1918, securing £15,000.

Banbury and District Electric Supply Co., Ltd.—Satisfaction in full on December 31st, 1923, of debenture dated March 26th, 1913, securing £300.

City Notes.

Chelsea Electricity Supply Co., Ltd.

The annual meeting was held on March 20th, under the chairmanship of Mr. W. R. Davies. The chairman, moving the adoption of the report and accounts (Electrical Review, March 21st, p. 464), said that although the gross receipts were higher, the net revenue was less, owing principally to the reduction of charges to consumers. They had taken the reasonable course of reducing the price for current consistent with the paying of a fair dividend. The company had resorted to a bulk supply from the Central Electric Supply Co., and as a consequence had dismantled and sold the whole of the steam plant. The loss on this transaction amounted to £65,286; this had been written off by the depreciation reserve fund, which, nevertheless, still stood at 50 per cent. of the total expenditure, apart from freehold land and buildings. The chairman then briefly outlined the proposals for the reorganisation of the London electricity supply, and the Bill embodying these was approved at a subsequent extraordinary meeting.

Folkestone Electricity Supply Co., Ltd.

The profit for 1923, including receipts from hired installations, was £37,591. After adding the balance brought forward (£1,498), &c., and deducting debenture interest and preference dividend there remains a balance of £30,469. The directors recommend a dividend of 6 per cent., free of tax, on the ordinary shares (making 10 per cent., free of tax, for the year), and it is proposed to contribute £17,971 to the depreciation fund, and £6,000 to the reserve fund, leaving £1,498 to be carried forward. The connections increased by 349 kW to 7,174 kW during the year. Further extensions to plant have been carried out, and negotiations are in progress, at the instance of the Electricity Commissioners, with the Dover Corporation for a linking-up scheme between Dover and Folkestone. Reductions have been made in charges and meter rents.

Bournemouth and Poole Electricity Supply Co., Ltd.

Mr. J. A. Hosker presided at the annual meeting, on March 20th. In presenting the report and accounts (*vide* Electrical Review, March 14th, p. 427), the chairman said that the capital expenditure had been increased during the year by £51,439, representing the cost of additional trunk mains, feeders, substations, and distributors. A new 3,000-kW turbo-generator had been installed at the Bourne Valley station, and in order to improve the working of the system it was intended to convert the Christchurch station into a sub-station. Dealing with the prospects for the current year, the chairman said that applications were coming in at the same rate as last year, and the output had shown an increase. Bournemouth was still developing, and the house-building programme was the largest in the last 20 years. Application was being made for powers to supply Broadstone and Wimborne.

Dublin United (Electric) Tramways Co., Ltd.

Mr. Joseph Mooney (Chairman) at the recent annual meeting, mentioned that the reduction of fares in August last had resulted in a drop of £11,000 in 18 weeks' receipts, although there had been an increase of 3,188,035 passengers, and since the beginning of this year they had carried 1,183,592 passengers more than for the corresponding period of last year, while receipts showed a decrease of £2,507. The circumstances pointed to the necessity for a reduction of wages as well as economies in other directions. They were considering the question of a 'bus service to outlying districts where traffic would not warrant extension of the tramway lines. The report was summarised in our issue of January 25th (p. 147).

Brompton and Kensington Electricity Supply Co., Ltd.

Mr. H. R. Beeton (chairman), addressing the annual general meeting on March 20th, briefly reviewed the financial results (*vide* Electrical Review, March 21st, p. 465), and said that whenever circumstances permitted it the company shared the benefits of reduced working costs with the consumers. The company was approaching the time of expiry of its Provisional Order, when it would be called upon to submit to an abatement, in some form, of the benefits which, when averaged over its early and unprofitable years, had sufficed to yield only a very moderate dividend upon the capital invested. The capital account had been increased by £8,850, mainly owing to the installation of fuel oil and of an evaporating plant for further economy in running. It was hoped that the adoption of oil fuel would enable the works costs to be kept as low as, if not lower than before. In conclusion, the chairman outlined the provisions of the electricity Bill now being promoted in Parliament, and at an extraordinary meeting which followed the Bill was approved.

Salisbury Electric Light and Supply Co., Ltd.

After providing for debenture interest, income tax, and depreciation, and writing off the cost of fitting up new offices and showrooms, there remained a balance of £6,757. An interim dividend of 4 per cent. was paid in October last. The directors recommend a further dividend of 6 per cent., free of tax, on the old shares (making 10 per cent. for the year), and also a dividend at the rate of 10 per cent., free of tax, on the new shares for six months. £2,000 is to be transferred to reserve and £507 carried forward. A new turbo-generator set is being installed at a cost of about £10,000. To meet the cost of this and further extensions the directors propose to increase the capital of the company to £25,000 by the issue of 10,000 ordinary shares towards the end of the year.

British Aluminium Co., Ltd.

The net profit for 1923 was £362,704, and £15,778 brought forward is added, making £378,482. The following provisions are made:—Taxation and proportion of profits payable to directors, £56,135; prior lien debenture stock service fund, £48,000; debenture stock service fund, £43,224; depreciation reserve, £50,000; reserve account, £60,000; and staff benefit fund, £10,000; leaving £111,123. The directors propose, in addition to the payment of preference dividends, a final dividend at the rate of 10 per cent. on the ordinary shares, making 7½ per cent. for the year, and £18,071 is to be carried forward. The capital expenditure during the year amounted to £42,246. All the works were operated at full production during the year, the demand showing a continued increase. The meeting is to be held to-day (Friday).

County of London Electric Supply Co., Ltd.

Sir Harry Renwick, K.B.E. (chairman), presided at the annual meeting on March 18th, and, in moving the adoption of the report and accounts (*vide* Electrical Review, March 14th, p. 426), said that the gross receipts had risen by 20 per cent., and the net profit showed an increase of over 34 per cent. The past year was a milestone in the company's history; its revenue had for the first time reached over one million pounds. The works at Barking were making satisfactory progress, and if all went well the initial plant in the station should be running by the autumn of this year. The strength of the company's position had been increased during the year by the purchase of a controlling interest in the South Metropolitan Electric Supply Co., and certain Kent electricity supply companies. The areas of these companies were adjacent to the company's area, and since the interests were acquired their position and that of the associated companies had considerably improved. The chairman then reviewed the position with regard to the re-organisation of the supply of electricity in London. He said that the question of a sliding scale of charges had not yet been settled between the companies and the London County Council, but he hoped that this would be such as to enable the companies to develop their business and to raise capital on the lowest possible terms. The parties supplying London with electricity were in three groups:—The municipalities, the "West End" group, and the County of London, City of London, the South Metropolitan, and the South London Companies forming what might be termed the "industrial" group. When the last group had obtained the necessary Parliamentary sanction, definite proposals would be submitted to the shareholders. These would be largely determined by the Electricity Commissioners' scheme which was to be issued in draft form very shortly. He felt certain that the group system was the right way of dealing with this re-organisation problem, and both the consumer and the shareholder would be benefited. The company was promoting a Bill for the extension of its powers in the county of Essex. In addition to the promotion of Bills, the company was putting up opposition to others.

The results for the current year were showing a marked increase, and working costs were remaining at about the same level.

Para Electric Railways and Lighting Co., Ltd.

In presenting the report (see Electrical Review, March 14th, p. 427) at the annual meeting on March 17th, the chairman (Mr. Follett Holt) said that the municipalities were now paying their current accounts regularly, although difficulty was being experienced in the collection of arrears. It was to be hoped that the report of the British financial experts who had been investigating conditions in Brazil would awaken the authorities to a better understanding of their duties towards foreign creditors. The rise in the value of the milreis led them to the belief that Brazil had "turned the corner."

Midland Electric Corporation for Power Distribution Ltd.

The report for 1923 records a net profit of £149,550, as compared with £139,876. To this is added £44,016 brought forward, making £193,566 (£170,480). £25,000 is allocated to reserve, £18,198 to depreciation, a special allocation of £30,000 is made, and £4,500 is placed to the debenture stock redemption fund. A final dividend of 5 per cent. on the ordinary shares is recommended, together with a bonus of 2½ per cent., making 12½ per cent. for the year, as against 10 per cent. in 1922.

Additional h.p. feeders are being laid at a cost of £29,000, and a new 5,000-kW set and boiler are being installed at a cost of £48,000. The directors propose to place a further £3,000 towards the staff benefit fund, in addition to £9,000 already contributed.

In presenting the report and accounts at the annual meeting held on March 24th, Mr. James Taylor (chairman) said that an extra amount of £30,000 had been written off for depreciation to compensate for the inadequate sums written off in the early days of the company. The demand for power had greatly increased, the sales in 1923 having reached 42,581,116 kWh, as compared with 33,402,183 kWh in 1922. The increased profit was due to the rise in output, and consumers had benefited by reduced charges. Probable increases in coal costs and wages would mean a serious rise in production costs, but it was hoped that increased demand and improved efficiency due to the installation of a new 5,000-kW generating set would meet this. The question of the reorganisation of electricity supply in the North-West Midlands area was still under discussion with the Electricity Commissioners, but there were indications that a final arrangement would soon be come to by the various authorities concerned. In view of the fact that the limits of the company's generating station had now been reached, a decision would soon have to be made on the question of a new station or a bulk supply. Discussing wages, the chairman said that the absence of stabilisation made it impossible to forecast costs; until a more permanent settlement was made there could not be business confidence and steady trade. The report and accounts were adopted, and a resolution sanctioning the payment of £120,000 from profits to a special reserve fund for the purpose of establishing a staff pension or benevolent fund was passed.

Rhondda Tramways Co., Ltd.

The net revenue for 1923 was £59,506 and to this is added £1,881 brought forward, making £41,387. Debenture interest and redemption fund, rent, and depreciation absorbed £17,998, and the directors recommend the distribution of the balance (£23,389) as follows:—Reserve and renewals accounts, £12,500 (omnibuses, £2,500); preference dividend, £8,000; carried forward, £2,889. The gross revenue fell from £122,603 to £119,217; the number of passengers carried rose from 11,593,641 to 13,392,799; and the number of car miles increased from 1,425,823 to 1,448,978. The meeting was held yesterday (Thursday).

Swedish Companies.

The *Elektriska Svetsnings* (*Welding*) *A.B.*, of Stockholm, reports net profits of 11,537 kronen for 1923 and a dividend at the rate of 3 per cent. On the other hand, Luth and Rosens Elektriska A.B., which incurred a large loss in 1922, is reported to have had a loss also last year, although of a smaller amount than in the preceding year, owing to the necessity for writing down old stocks.

Prospectuses.

Hoffmann Manufacturing Co., Ltd.—Last week this company issued a public prospectus offering for sale 500,000 7½ per cent. cum. pref. shares of £1 each at par. The company has 3,000 men employed at its Chelmsford works, and the Norma Co. of America, in which the Hoffmann Co. is largely interested, is making steady progress, and erecting new works at Stamford, Connecticut, which will be in full running next July, giving a greatly increased output.

Vickers, Ltd.—An issue of £2,000,000 5½ per cent. first mortgage debenture stock at 98½ per cent. was offered last week. The company, besides its other large activities, owns over 90 per cent. of the capital of W. T. Glover & Co., Ltd., and a controlling interest in the Metropolitan-Vickers Electrical Co., Ltd. The proceeds of the issue are for the repayment of the 7 per cent. seven-year notes of the company and for general purposes.

Sir W. G. Armstrong, Whitworth & Co., Ltd.—This company has placed with a financial house £2,000,000 5½ per cent. three-year notes.

Melton Mowbray Electric Light Co., Ltd.

The annual meeting was held on March 21st, Mr. W. J. New presiding. The result of the year's trading shows a gross profit of £9,512, against £7,856 in the previous year. The chairman said that during the year 2,000 additional £5 shares had been issued, raising the issued share capital from £20,000 to £30,000. Two reductions in lighting rates, besides reductions in power and heating rates, were made last year, but the directors could not see their way clear to further reductions at present. Before next winter they would have to provide a further 500-kilowatt set or be faced with the risk of a breakdown due to overload. It was therefore essential that they should put aside substantial sums for renewal. He moved that a dividend of 10 per cent. for the year be paid, and that £2,000 be carried to the general reserve fund, leaving a balance of £682 to be carried forward. Mr. F. E. Gripper seconded, and this was agreed to.

Yorkshire (West Riding) Electric Tramways, Ltd.

The net income for 1923, after providing for debenture interest, was £45,258, to which is added £7,780 brought forward, making £53,038. After the payment of the preference dividends, and allocating £14,009 to the purchase of funded preferential dividend certificates, the directors recommend a dividend of 5 per cent., less tax, on the ordinary shares, absorbing £7,875. The renewals, depreciation, and reserve fund is to receive £20,124, and a balance of £360 is carried forward. Meeting to-day, Friday.

Electro-Bleach and By-Products, Ltd.—The annual meeting was held on March 19th, under the chairmanship of Mr. H. D. Butchart, in the absence of Mr. A. T. Smith. The chairman said that, although the 1923 figures did not reach the high figures of some previous years, the results were satisfactory, especially when regard was had to the difficulties of the times. The general feeling of insecurity engendered by labour troubles forbade prophecy, but he (the chairman) knew of no company in which a better feeling existed between the managers and the men.

Imperial Tramways Co., Ltd.—The balance available after paying debenture interest, and dividends on the preference shares is £3,751, and it is proposed to carry this amount forward. The company receives a dividend of 6 per cent. in respect of its ordinary shares in the Bristol Tramways and Carriage Co., Ltd. A dividend of 2½ per cent. was received from the arrears on the cumulative preference shares of the London & Suburban Traction Co., Ltd. The meeting is to be held to-morrow (Saturday).

Newmarket Electric Light Co., Ltd.—The gross profit for 1923 was £5,593 (as compared with £5,374), and after providing for debenture interest, £710, income tax, £530, and reserve for renewal of plant, £1,750, and adding £267 brought forward, there remains a balance of £2,870. The directors recommend a dividend of 6 per cent., free of tax, the placing of £750 to general reserve, and the carrying forward of £526. The 33-W lamp equivalent connected rose by 1,485 to 43,729.

Bruce Peebles & Co., Ltd.—Addressing the annual meeting on March 14th, Mr. James Watt (chairman) said that in spite of the trying circumstances in 1923 the dividend had been maintained. The company had never been in such a secure position. Since the beginning of the year there had been a substantial increase in the number of orders received.

Calcutta Electric Supply Corporation, Ltd.—A statement has been issued by the company showing the progress made between the years 1901 and 1922 in the number of houses connected, gross revenue, energy sold and dividends. The kWh sold during 1923 were 66,444,423, representing the remarkable increase of 14,845,844 over the total for 1922.

Swiss Company.—The *Schweiz Gesellschaft für Elektrische Industrie*, of Glarus, has now issued its report for 1923, showing net profits of 1,790,000 fr. as compared with a loss in each of the two preceding years. It is proposed to pay a dividend at the rate of 6 per cent. on the two classes of shares.

Radio Corporation of America.—*Exchange Telegraph* reports that the gross revenue rose from $14,830,000 in 1922 to $26,395,000 last year. The net revenue was $4,738,000. The gross sales of receiving apparatus at $22,465,000 were practically double those of the preceding year.

Singapore Electric Tramways, Ltd.—Meetings of the debenture-holders, shareholders, and English creditors were held on March 20th, when it was agreed that the reconstruction of the company under the auspices of the Shanghai Electric Construction Co., Ltd., should be proceeded with.

Shawinigan Water and Power Co.—The net profit for 1923 was $1,981,560 on gross earnings of $5,110,539. A dividend of 7 per cent. is paid on the common shares, and a balance of $315,813, subject to tax, is carried forward.

Sir W. G. Armstrong, Whitworth & Co., Ltd.—A final dividend has been declared on the ordinary shares, making the distribution 1s. per share, as in 1921 and 1922.

Browett, Lindley & Co., Ltd.—Final dividend of 2 per cent. actual on ordinary shares, less tax, making 6 per cent. for the year. £476 carried forward.

Robey & Co., Ltd.—Dividends of 2½ per cent. on both preference and ordinary shares were recommended. £13,347 is carried forward.

Lima Light, Power, and Tramways Co.—A meeting of shareholders in this company is being held in Lima, Peru, to-day (Friday).

Gandy Belt Manufacturing Co., Ltd.—Final dividend of 2s. 6d. per share, making 4s. for the year (20 per cent.), free of tax.

County of Durham Electrical Power Distribution Co., Ltd.—Dividend of 6 per cent. on the ordinary shares for 1923.

British Insulated & Helsby Cables, Ltd.—The annual meeting was held on Monday last, under the chairmanship of Mr. James Taylor. A report will appear in our next issue.

Stocks and Shares.

Monday Evening.

One of the main features in the Stock Exchange markets during the past few days has been a sharp fall in the prices of Tube railway issues. With this has come a general depression in shares and stocks of the London traction concerns. The flatness owes its inception to the statement, published by Lord Ashfield at the end of last week, in which he points out that the three Greater London tramways, for the first two months of the present year, failed to meet their fixed charges, while the associated railway companies, of which the Metropolitan-District stands at the head, had a balance after two months' working of £1,500, as compared with £197,000 for the corresponding period a year ago. The figures came as a complete surprise to the market and shareholders alike. A good many people hastened to sell their stock, and, although it was assumed that the writer of the statement was not likely to make out the best case possible for the companies in view of the imminent strike, yet Lord Ashfield has a sound reputation for sticking to facts, and the figures were accepted as being trustworthy.

Underground income bonds at 97 are 3 down, Districts at 51 are a point lower. Oddly enough, Metropolitan has risen to 75¼, which is ¾ up on the week. Earlier it touched 76¼. London & Suburban Traction preference fell to 5s. 6d., London United Tramways preference to 1s. 9d., and the latter company's debenture stock to 50. On the other hand, British Electric Traction rose to 73½. North Metropolitan second preference at 102½ is down a point.

The electricity supply list is very firm, and as usual, what changes have occurred are mainly in the upward direction. Reference has been made here already to the substantial amounts of stock and shares that have recently been in course of realisation on behalf of a very large deceased account. The principal part of the selling is over for the moment, and it is a matter for congratulation that so many shares have been realised without this bringing about any noticeable dulness in the prices of the shares dealt in. At the County of London meeting the other day, Sir Harry Renwick, the chairman, referred in glowing terms to the future for the industry and for his own company. It may be useful to point out that the new shares of the County company are now identical with the old. The prices are 49s. 6d. middle for the ordinary and 22s. 6d. for the preference. No new issue is contemplated by the County company at present.

St. James's make the best showing of the week, with a rise of 7s. 6d. to 13½. Westminsters are good at 10¾. Edmundson's rose to 4½, and Urbans have gone up to 1. South Londons at 44s. 6d. show a rise of 1s. 9d. The improvement spread to Whitehall Electric preference, which at 20s. 6d. have recovered the dividend deducted last week. The market is good throughout, and the strength extends to shares in the provincial companies.

These last-named are showing results which vie with those of London in their stisfactory nature. Bournemouth and Poole keeps strong at 48s. 6d. Folkestones at 7 are 12s. 6d. better, on the increased dividend. Oxfords are a good market at 5 x.d., the 5 per cent. preference being 4. Yorkshire Electric Power ordinary strengthened to 27s. 3d., and the 6 per cent. preference stand higher at 22s. 6d. Newcastles are again better at 20s., thanks, of course, to the jump in the dividend. Bromley (Kent) Electric ordinary at 34s. 6d. are amongst the others which show improvement on the week. Tees Power 6 per cent. debenture stock has hardened to 103.

Cable stocks are steady, and Eastern ordinary at 169½ is up 1. Westerns at 16¼ are better, in that the price is now ex dividend. Anglo-American deferred eased off to 22¼. Great Northerns to 27¾. Pronounced weakness occurred in Marconi ordinary, the price going back to 32s. 6d. upon selling, the source of which was difficult to trace. In some quarters, it is thought that the sales came about partly as a result of the necessity for weak speculators, in foreign exchanges and in base metals, to get rid of other investments in order to meet liabilities that have arisen out of their transactions.

Manufacturing descriptions are a placid market. British Aluminiums have put on ninepence to 23s. 3d., shares changing hands up to 23s. 10½d. English Electrics gained a few pence, and General Electrics have lost threepence. Other movements are equally trivial. Henleys and Callenders maintain their last week's rises. Telegraph Constructions return a level 5 per cent., free of tax, on the money now that the price is quoted ex dividend.

Brazilian Tractions fell away to 56¼ as the milreis went back to 5⅝, but on a rise in the exchange to 6¼d., the price rallied to 59, which is ½ higher on the week. British Columbia new debenture keeps good at 6¾ premium. Mexicans seem tired: the Utility prices are heavy, and the stocks attract no public interest worth mentioning. City of Buenos Ayres Trams strengthened to 4¼, and the Anglo-Argentine group is steady.

While engineering shares remain stationary, iron and steel continue to dwindle in price. There was a brisk demand for Vickers new issue of two million pounds 5½ per cent. debenture stock at 98½, the subscription lists being promptly closed. Armstrongs have recently placed an equal amount of 5½ per cent. short-term notes. Rubber shares are dull and stagnant upon the price of the produce being down to a shilling per lb.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1922.	Dividend. 1923.	Price Mar. 24. 1924.	Rise or fall.	Yield. p.c.
Brompton Ordinary	1	12	10	38/9	—	*£5 3 3
Charing Cross Ordinary	1	14	14½	46/6	—	6 4 9
do. do. do. 4½ Pref.	1	4½	4½	17/-	—	5 6 0
Chelsea	1	10	12	38/9	—	6 8 0
City of London	1	15	15	49/6	—	6 1 2
do. do. 6 % Pref. ...	1	6	6	23/-	—	5 4 4
County of London	1	10	15	49/6xd	+1/9	6 1 2
do. do. 6 % Pref. ...	1	6	6	1½xd	—	5 6 8
Edmundson's Ordinary ...	3	7	7	4½	+ ⅛	5 2 7
do. 6 % Pref.	5	6	6	4½	+ ⅛	6 1 6
Kensington Ordinary	—	12	14	10½	—	6 13 4
London Electric	3	10	10	4⅝	—	6 3 10
do. do. 6 % Pref. ...	5	6	6	5⅛	—	5 11 7
Metropolitan	1	8½	10	1½	—	5 13 4
do. 4½ % Pref.	1	4½	4½	17/-	—	5 6 0
Newcastle-on-Tyne Ordinary ...	1	2½	6	1	+ ⅛	6 0 0
do. 5 % Pref. ...	1	5	5	16/9	+6d.	5 19 5
do. 7 % Pref. ...	1	7	7	23/6	—	5 19 2
Notting Hill 6 % Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6 % Pref. ...	1	6	6	22/-	—	5 9 1
Urban Ordinary	1	—	—	1	+ ⅛	Nil.
do 6 % Pref. ...	1	5	5	17/6	—	6 17 2
St. James' and Pall Mall ...	5	14½	17½	13½	+ ⅜	6 13 4
South London	1	11	15	44/6	+1/9	6 14 10
South Metropolitan Pref. ...	1	7	7	24/6	—	5 14 3
Westminster Ordinary	5	12	15	10⅜	+ ⅛	6 19 6
Whitehall Elec. Invst. 7½ % Pref.	1	7½	7½	20/6xd	+6d.	7 6 4

Home Rails.

Central London Ord. Assented Stock	4	4	68½	—	5 16 10
Metropolitan ... ... ,,	8½	4	76⅜	+ ⅜	5 5 7
do. District ... ... ,,	3	3½	51	—1	6 17 3
Underground Electric Ordinary	10	Nil	Nil	2⅜	—1/8	Nil
do. do. "A" ...	1	Nil	Nil	7/9	—3d.	Nil
do. do. Income Bonds	5	6	97	—3	*6 3 9

Telegraphs and Telephones.

		Dividend. 1921	Dividend. 1922			
Anglo-Am. Tel. Pref.	Stock	6	6	102	—	5 17 9
do. Def.	,,	1½	34/6	22⅜	— ⅛	6 14 1
Chile Telephone	5	6	6	6⅛	—	4 18 0
Cuba Sub. Ord.	10	7	7	7½	—	9 13 2
Eastern Extension...	10	10	10	16⅝	—	5 18 6
Eastern Tel. Ord.	Stock	10	10	169½	+1	5 18 0
Globe Tel. and T. Ord.	10	10	10	17xd	—	5 17 8
do. do. Pref.	10	6	6	10⅜xd	—	5 11 7
Great Northern Tel.	10	24	22	27½	— ½	8 0 0
Indo-European	25	10	7	32½	—	*5 7 8
Marconi	1	25	15	1⅜	— ⅛	9 4 8
Oriental Telephone Ord.... ...	1	12	12	13	—	*6 17 2
United R. Plate Tel.	5	8	8	6⅛	—	*5 16 6
West India & Panama	10	Nil	Nil	1/-	—	Nil
Western Telegraph	10	10	10	10½xd	+ ⅛	6 1 3

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	12½	3⅞	—	8 5 0
do. do. 2nd Pref. ...	5	Nil	5½	2⅛	—	10 4 4
do. do. 5% Deb. ...	Stock	5	5	74½	—	6 14 3
British Electric Traction Ord. ...	,,	4½	5	73½	+1½	6 16 0
do. do. 6% Pref. ...	,,	6	6	99½	+1	6 0 6
Brazil Traction	100	Nil	4	59	— ½	6 15 7
Brit. Columbia Elec. Rly. Pcs.	Stock	5	5	83½	—1½	5 19 9
do. do. Preferred	,,	5	96/-	86½	—2	*5 15 3
do. do. Deferred	,,	8	127/-	100½	—1½	*6 8 9
do. do. Deb.	,,	4½	4½	76½	—	5 11 1
Lond. & Sub. Trac. 5 % Pref. ...	1	8½	5	5/6	—6d.	9 1 10
London United Tram. Deb. ...	Stock	4	4	£0	—1½	8 0 0
Mexico Trams. 5% Bonds ...	—	Nil	Nil	7½	—1½	6 18 0
do. 6% Bonds ...	—	Nil	Nil	60½	—1	Nil
Mexican Light Common ...	100	Nil	Nil	25½	—	Nil
do. Pref.	100	Nil	Nil	47½	—1	Nil
do. 1st Bonds ...	—	Nil	5	68½	—	7 6 0

Manufacturing Companies.

Babcock & Wilcox...	1	15	20	46/3	—	*4 6 8
British Aluminium Ord.... ...	1	10	5	23/3	+9d.	4 5 10
British Insulated Ord. ...	1	15	15	2⅜	—	6 0 0
Callenders	1	15	15	48/9	—	6 3 0
do. 6½ Pref....	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	10	5	⅜	—	10 0 0
Edison-Swan	4/-	10	Nil	4/9	—	6 6 4
do. ,, 5% Deb. ...	Stock	5	5	77½	—	6 9 0
Electric Construction	1	10	10	1⅛	—	6 7 5
English Electric	1	8	5	18/-	+3d.	5 11 1
do. do. Pref.	1	6	6	19/-xd	—	6 6 4
Gen. Elec. Pref.	1	6½	6½	23/-	—3d.	5 13 1
do. Ord.	1	10	5	20/9	—	4 18 5
Henley	1	15	15	2⅞	—	6 3 0
do. 4½ Pref.	5	4½	4½	4½	—	5 9 1
India-Rubber	1	10	10	⅝	—	*6 13 4
Met.-Vickers Pref....	2	8	8	2⅞	—	6 5 0
Siemens Ord.	1	10	10	17/3	—	Nil
Telegraph Con.	12	20	20	24xd	—	*5 0 0

* Dividends paid free of Income Tax.

The Batti-Wallahs' Society.

Annual Dinner.

THE annual dinner of the Batti-Wallahs was held at the Hotel Cecil on Wednesday, March 19th. Mr. A. J. Greenly, the president, was in the chair, and amongst the guests were the Rt. Hon. Frank Hodges, P.C., M.P., Civil Lord of the Admiralty, Mr. C. H. Wordingham, C.B.E., Capt. J. M. Donaldson, M.C., Messrs. H. Marryat, J. W. Beauchamp, and E. Reeves, and the Hon. Miss R. Parsons.

After the loyal toast, Mr. E. S. Barralet proposed "The Visitors," claiming that their most important guest, Mr. Frank Hodges, was entitled to be called a "Batti-Wallah," having commenced his career as a lamp-boy—in a coal mine. He said that they were not satisfied with the progress of electricity supply in this country, and he put several questions as to the causes which had hindered its development.

Responding to the toast, Mr. Frank Hodges said he believed that this country was hopelessly behind in electrical development. Before he took office he had imagined that it was a most important duty of the Government to be deeply interested in the development of electricity supply; but their tenure of office was uncertain, and whether the Government would have time under the existing conditions to develop their ideas about electricity control was very questionable. However, he hoped the men who were engaged in the electrical industry would give the matter their closest attention, for the country that provided itself with an ample supply of electrical power was on the high road to prosperity. Our backwardness was due to the intense individualism which characterised the British people, and which rendered co-operation distasteful; municipalities were likewise inspired by individualism, derived from their individualistic members. If they could not combine, they could not hope to make the progress that they ought to make. No benefit would come from reducing wages to starvation point; progress would be made with high wages, brought about by the liberal use of mechanical power, and that could be effected only by the development of electricity supply on the largest possible scale as the result of co-operation. They could afford to differ politically, but they could not afford to differ commercially and industrially. Their whole future depended upon their providing for the scientific mind to develop with freedom, so that the maximum possible production could be obtained from their own natural resources.

Mr. C. H. Wordingham, M.Inst.C.E., also responding for the visitors, referring to the remarks of Mr. Hodges, refused to admit that this country was terribly behind; here the conditions were very different from those obtaining in the United States and Canada, as electricity in this country had to compete with cheap coal and cheap gas. As for the suggested unwillingness to co-operate, Mr. Hodges apparently was unaware that they were actually forbidden by the Government to co-operate, until the Act of 1919 was passed. Engineers in this country did not suffer from undue caution; Ferranti in the 'eighties had led the way for the whole world, and most of the great inventions that made electrical progress had emanated from this country. One of the most potent factors for future progress was research, which hitherto had not been adequately recognised in this country. Brains were available for research, if the funds could be found, and the outlay would bring immediate results.

Miss Rachel Parsons, responding to the toast, after referring to the excellent speech of Mr. Hodges, remarked that last year she got 6,000 miners to vote Conservative, largely as the result of quoting Mr. Hodges's report that there was no unemployment in the United States, where prosperity was universal; and that was the result of a policy of Protection. Miss Parsons had heard Mr. Hodges make a speech in the House of Commons, just before the last Government was overthrown; he advocated the generation of electricity at the pit's mouth, so that the labours of the miners might be alleviated, but now nothing was heard of that. Instead, he said that ideals were most difficult to realise in practice, and she pointed out that they must return to saner methods.

Mr. J. W. Beauchamp, also responding, remarked that the Minister ran down individualism, but was there any character other than individualism that would have made a Cabinet Minister out of a miner? They should not compare America with this country, as the conditions were totally different. The Minister said there was no time to deal with the subject of electrical development, but what would he do if he had the time? He would meet with a series of disappointments. The speaker was of the firm opinion that so far as the consumer was concerned the difference between company control, municipal control, and State control would be very small—if any. If all the profits were abolished, the consumers would be no better off. The factor that would make the greatest difference was not the method of production, but a radical change in the manner of using the supply. They must alter the shape of the load curve, and that would be the best way to benefit the consumer. If civilisation was to continue to increase in complexity, they must give up the wasteful use of heat energy and economise in the utilisation of their perishable assets, in the interests of the race. That was a question which had nothing to do with profits, and might well be dealt with by the State, provided that it left their initiative and energy untrammeled.

Mr. W. Riggs proposed "The Society and its President," and after referring to Mr. Greenly's past services to the Society as hon. secretary, presented him with a watch on behalf of the members in token of the esteem in which he was held by them. The president, acknowledging the gift, said the Society had had a set-back from the war, but was now more influential than ever before.

There was a large attendance of members and guests, including many ladies, and the proceedings, which were enlivened by an excellent musical programme, were thoroughly enjoyed.

Electric Railway Signal Machines.

By J. BOOT.

(*Abstract of paper read before the* INSTITUTION OF RAILWAY SIGNAL ENGINEERS.)

THE increasing limits and complication of interlockings, and the shortening of existing sections, demand the extended use of power-operated signals.

More extended use might be made of solenoids for operating semaphore signals. It is not impossible to design some form of quenching device to obviate heavy sparking at signal posts and in cabins. The author was associated, some years ago, with experiments which proved that great economy could be effected in current consumption by the interposition of suitable gearing or connections between the electromagnet and the mass to be moved. When the armature was connected to the signal-operating crank by a spring which stored up nearly the whole of the energy imparted by the armature before the signal commenced to move, the force applied to the signal was in the opposite ratio to that exerted by a direct-coupled armature, in that the greatest pressure was applied to the signal at the commencement of its movement. The armature acted instantaneously, and the electrical energy was reduced by more than 75 per cent.

The direct-pull type of machine is best adapted for d.c., but is only suitable for installations where power is available. The electromagnetic type of movement is very suitable for operating small semaphore arms, ground disk signals, and the enclosed banner type of signal. Motor-operated machines are suitable for either d.c. or a.c. at high or low potentials.

There are two sets of conditions which have an important bearing on the electrical lay-out, especially if the machine has to be worked from primary cells. A standard signal machine would probably require 2.5 amperes at 10 volts when the motor is running (ignoring the first rush), and .01 ampere at 10 volts when the clutch is in circuit only. It is usual for the makers to supply machines requiring approximately the same potential difference across the terminals of both the motor and the clutch coils, but in practice this can seldom be arranged, owing to the internal resistance of the battery and of the wiring and possibly the relay contacts. When the motor is running the potential across the terminals of the machine will be approximately 10 volts, but when the motor circuit is opened, leaving the clutch in operation, the potential and current will rise approximately 40 per cent. above normal. This may have a tendency to prevent the quick release of the clutch, and it would appear advisable to insert a resistance in the clutch circuit. By doing so not only is saturation of the iron in the magnetic circuit prevented, but the length of service given by the battery is considerably increased. This is, no doubt, an efficient expedient, and it is a matter for consideration whether it would be advisable to specify the working voltage of both the motor and clutch.

The self-contained machine carrying the semaphore and spectacle direct on the main shaft and fixed at the top of the post is preferable wherever it can be used, while in the case of three-position signals this type is indispensable. When the machine is fitted near the bottom of the post it is more accessible, but more attention might sometimes be given to the accessibility of the oil and grease cups. When dashpots are fitted special attention has to be given by the maintenance staff to the cleaning of the cylinder walls. Oil dashpots might be used instead of the usual air type, but experience has shown the necessity of keeping them outside the case of the machine, as there is difficulty in keeping them oil-tight.

New installations of large magnitude will probably be equipped with colour light signals, but there is still a large field for an inexpensive, very simple and robust electric machine which will perform its work over prolonged periods with little or no attention.

New French Company.—*La Société d'Installations de Lumière et de Forces Electriques* is the name of a new company which has lately been formed in Lille with a capital of 320,000 fr.

The British Electrical and Allied Manufacturers' Association.

Mr. Longbottom's Speech and the Council's Report.

The annual meeting of the B.E.A.M.A. was held in London on Thursday, March 20th, when the report of the Council for the year 1923, of which an abstract appears below, was adopted. The business was of the usual formal character. The accounts were submitted and adopted, and the election of members of council and of the auditors took place. Mr. B. Longbottom was again re-elected chairman, a very wise arrangement seeing that interest that he has taken in all that appertains to the Wembley Exhibition.

On the same day a large and representative company sat down to luncheon at the Connaught Rooms, under the presidency of Mr. B. Longbottom, the chairman of the Council, who delivered an interesting address on a number of matters affecting the electrical industry, including the general industrial situation, research, unemployment, the Home trade, the foreign market, Imperial Preference, the British Empire Exhibition, and the World Power Conference. He closed his speech with a welcome sentence which indicated the desire of the Association that those who were not so familiar with its work should be provided with fuller information regarding its activities. Other well-known men delivered brief addresses, from which it was obvious that they too thought that less reticence and fuller publicity were required in the best interests of the organisation and of the industry.

Sir Philip Nash, K.C.M.G., who proposed the toast of the B.E.A.M.A. Council, said that the electrical industry had become more and more enlarged, and he was convinced that there was a very important and an increasingly important function before the Association that they knew as the B.E.A.M.A. It appealed to him as a part, and a very necessary part, of the organisation of the electrical industry. There were many questions, very important questions, which had to be considered collectively, and had to be answered collectively, and the B.E.A.M.A. was the proper place for those to be considered, and there the answers should be framed. They desired a strong and efficient council for the future, not that the last one had been anything but strong and efficient. He thought that the B.E.A.M.A. should be more publicly known and more publicly recognised than it had been in the past, and he was sure that the Council would not shrink from letting it be known in a far wider degree. There were great opportunities occurring in the present year in that the British Empire Exhibition was being held, and, further, that the World Power Conference would be held in London. The B.E.A.M.A. had taken a very active interest not only in the Exhibition but in the World Power Conference, and it seemed to him that the present year was peculiarly a good one to make the functions and operations of the B.E.A.M.A. more widely known.

Mr. L. B. Atkinson, in supporting, said that he did not think the B.E.A.M.A. Council realised their present position and their present power, and what it was they could accomplish if they chose to do so. They were too reticent, too moderate, not sufficiently courageous at times to take up the leadership to which they were entitled in that great industry. He thought the Council had reached a point where it was their right and duty to be a little more insistent and to see that their views were expressed. If they were reticient in some respects they were far-sighted and long-viewed in one or two directions, notably in the Electrical Research Association which was achieving results which were going forward at compound interest. The foundation work in this connection was something which was not sufficiently made clear to the industry and to other industries, and not sufficiently recognised as to its immense value.

The Chairman's Address.

In replying, Mr. Longbottom said:—

There has been a consensus of opinion that the year now past represented a return to normal conditions of trade, and, although the actual improvement that occurred in industrial activity may have been comparatively slight, the stage has been set for a more prosperous state of trade in 1924. This return to greater activity can be seen in the growing restlessness of labour, and we have already manœuvred safely through two strikes of national importance without risking any of the first movements towards trade recovery. The threat of a greater national danger than any through which we have passed—the coal wages dispute—may induce a spirit of pessimism, but the interests of Labour and Capital are now so closely interlocked that labour itself has ceased to be revolutionary and is alive to the value of conciliation.

There is no doubt, however, that industry is on a rising plane of activity. This opinion has been cautiously advanced by the chairmen of the five banks, in their annual speeches to the shareholders, and the main symptom on which their diagnosis was based, the increase in advances made by the banks for trade purposes, has, if the returns for January and February are considered, shown a marked tendency to become more powerful still. This is undoubtedly a good sign since industry draws its life-blood from credits, and a decline in credits means anæmia.

The electrical industry, fortunately, has been more continuously employed than, perhaps, any other industry since the conclusion of the war. The reorganisation of the generation and distribution of power laid down in the Electricity Act of 1919 has steadily progressed. The virtual conclusion of the legal dispute regarding the London and Home Counties Electricity District adds a third district to the two already finally determined—the South-East Lancashire and South-West Midlands District—and it is probable that this year will see the completion of investigation into the West of Scotland and the West Riding (Aire and Calder) Districts. Those five districts cover the most important industrial regions in Britain, and the final regrouping of power distribution, with its sequel in the creation of large central stations built on the most modern design, and the elimination of small inefficient stations will mean, in each case, a great increase in the demand for generating plant.

We have not yet reached the stage of the super-power station as exemplified in Paris and New York, but we have shown that, in the power station designed at present by our engineers, a degree of efficiency has been reached as high as, and even higher than that reached by the French or American stations.

Research.

We have listened for some years now to advocates of research in industry, American and British, sometimes with pity, sometimes with boredom, but more often with sheer misbelief, secure in the idea that technically we had nothing to fear. Recent developments have shown how mistaken this attitude has been. Steam temperatures and pressures have risen, for example, beyond the limits of the materials at our disposal, and productive costs have increased enormously through the necessity to use expensive materials, where research might conceivably have improved cheaper materials to the standard required, or invented new ones. Transmission voltages have soared from 30,000 volts to 220,000 volts, and apparatus has had to be designed to meet such voltages at a time when there was some doubt as to the effects of these voltages on materials and systems. The rate of development becomes more rapid each year, and the lag between research and design increases steadily. In addition to this, the study of pure science has been found to have a direct bearing on electrical manufacture; the application of the thermionic valve to power purposes is a case in point. The importance of pure and applied research has long been recognised in the United States, France, and Germany, and we are definitely behind those countries in provision for research. The justification for research is absolutely economic. Our capacity to compete in the markets of the world depends on our ability to give greater efficiency at a lower cost than our competitors, on our ability to foresee and provide for developments which may otherwise render our manufactures obsolete.

Unemployment.

Indications of greater activity can be seen in the statistics of unemployment in the general engineering and electrical engineering industries. From June, 1923, onwards, the recovery in engineering has been continuous, while, in most industries, the tendency until recently has been to remain stationary. The decline in *general engineering* from June, 1923, to January, 1924, has been from 141,213 unemployed to 128,973; in *electrical* engineering from 3,995 to 3,671; in electrical *cable, wire, and lamp* manufacturing from 7,131 to 5,950. In January, 1924, only 5.9 per cent. of the workers insured in *electrical* engineering were unemployed, compared with 19.1 per cent. in *general* engineering and 11.8 per cent. in *all* industries.

This activity in the electrical industry has only been achieved by considerable sacrifice, as it has been the consistent endeavour of employers to secure contracts, often at most unremunerative prices. By this means they have been enabled to keep their workpeople together, the importance of which, irrespective of the humane point of view, cannot be overestimated in a skilled industry.

Home Trade.

Electrical manufacture has returned definitely to the level fixed by the relation between productive costs and selling prices which existed before the war, and as a result of immensely increased taxation, this level means a considerable reduction in profits. The analysis made by the *Economist* from the reports of 1,351 companies in all industries showed that the percentage of net profits earned to the ordinary capital invested was 9.3 per cent. in 1923, as compared with 10.2 per cent. in 1913. A similar analysis made for the electrical industry alone shows a ratio not exceeding 7 per cent. in any year since 1921. Competition has been excessively keen even in the home market, due to considerably increased manufacturing facilities on the one hand and to low foreign tenders on the other. The danger of competition from abroad in the home market is a danger which must continually be faced. The British manufacturer is wholly unprotected against competition from countries with depreciated exchanges and a low standard of living. The policy of buying in the cheapest market is dangerous, not only to industrial prosperity, but also to social progress. A high standard of living is incompatible with industry forced down to starvation level.

The Foreign Market.

The increased activity of the home market in the latter half of the year found a reflection in a recovery in exports, the last six months of 1923 being the most promising since the end of 1921. Circumstances have changed enormously since 1919 owing to the wave of nationalism that has swept over the whole world. The theory of self-sufficiency in everything, in engineering especially, has led to the erection of formidable tariff barriers which have increased the price of imported goods beyond the purchasing power of the people who formerly imported them. Political changes, causing the geographical and economic disruption of markets, notably in Central Europe, have complicated the issues and reduced business in many countries to a state of chaos.

Apart from this, the foreign markets presented many points of interest during 1923, and the position of Britain in electrical exports improved considerably, even if the comparison includes the record year 1921. The initiation of important hydro-electric schemes in the Dominions, the progress of railway electrification in South Africa, Japan, Brazil, and India, the opening up of new markets in the Baltic States and the continued activity of the Australian market have combined to make the past year one of the most notable in the post-war period. We have come appreciably closer to normal conditions of trade, and this return can already be seen in a slight revival in European states once considered irrevocably lost. The record crops reaped in the Argentine, the stronger European demand for Chilian nitrate, and the greater shipments of coffee from Brazil encourage the hope that the long period of financial depression ruling in South America is over at last and that a greater demand for electrical goods will be a feature of that trade in 1924.

Imperial Preference.

While the desire for increased tariff barriers showed signs of abatement in 1923, the danger is by no means over, and the uncomfortable truth remains that a great impetus has been given to electrical manufacture in Spain, France, Italy, Belgium, and Czecho-Slovakia not only to meet the demands of their home markets, but also to extend to Great Britain and the British Dominions. From this point of view it is vitally necessary for us to tighten the links that bind us to the Dominions; and while Imperial preference, in the form advanced a few months ago, has been temporarily discounted, some effective substitute must be found for it. The electrical industry is more directly concerned in this matter than any other industry. Examination of foreign trade returns will show that in 1913 the Dominions took 46 per cent. of the electrical machinery exported and, in 1922, 71 per cent. In other words, our export market in electrical machinery is now almost wholly a Dominion market. Yet, in the Dominions themselves, our position is not absolutely safe, although India and New Zealand have not so far flinched in their allegiance to the British electrical industry. Foreign competition has entered to the extent of almost 50 per cent. into the Australian market. Provisional returns for 1923 have shown a decline to less than 47 per cent. imported from Britain. The position is better in the South African market, where the percentage of the total imports of electrical machinery supplied by Britain has risen from 32 per cent. in 1913 to 60 per cent. in 1922, while India is the most valuable of all three, the percentage remaining on a fairly constant level at 76 per cent. since 1920, compared with 86 per cent. in 1913. The loss of the Indian, South African, and Australian markets would bear with it the destruction of our export trade in electrical engineering, and this is a point we cannot afford to overlook. We must maintain our hold on those markets at all costs.

It is fortunate that just as we have come to realise the seriousness of our world position in these matters, we are afforded by the British Empire Exhibition at Wembley probably the most effective of all means of displaying to our Dominion and oversea friends the capacity and skill of this country for the production of electrical and allied machinery.

Most of you here are familiar with the splendid effort of the Association in organising the whole electrical and allied section of that Exhibition and equipping it with a complete power station. You will find all details set out in your annual report, together with details of an even more remarkable effort of mind—the organisation of the first world conference ever held on the subject of power.

We may hope that amongst the millions of people who will be visiting Wembley this year it will be found that a not inconsiderable proportion were of that most desirable of all classes—our excellent friend, THE PURCHASER!

In response to a vote of thanks, the chairman thanked the gathering for their cordial reception, and said he could not have continued his work as chairman of the Council without the assistance of Lord Derby, their president, who would have been present but for a previous appointment.

The vote of thanks to the chairman was accorded on the motion of Mr. P. J. Pybus.

THE REPORT OF THE COUNCIL.

The report for the year ended September, 1923, commences with a reference to the dinner held in November last at which the Prince of Wales referred to the importance of our maintaining a lead in electrical development. The Council at the close of the year ordered the preparation of an account of the work of the Association during the past eleven years and this, it is stated, was duly issued. The report summarises the outstanding achievements, the earliest success being the co-operation between the I.E.E. and the B.E.A.M.A.; the next being the effort towards standardisation on a considerable scale; others being of later growth and much slower development, namely, education and research. "£300,000 annually is the estimated aggregate bill of costs for 'research' expended by your members, apart from the financial support given to the E.R.A."

The Association took advantage of the Imperial Economic Conference and the visit of the Dominion Premiers, to put directly before them its views on the vexed question of specific versus *ad valorem* import duties and other matters. This they did in a considered memorandum showing in what way *ad valorem* duties have the effect of favouring importations from countries with the lowest standard of living and effectively wiping out the benefits which the Dominions, by giving a preference to British goods, purport and intend to confer upon British manufacturers. Statistics were presented which showed that the idea of specific duties (weight, number, or quantity) is gradually taking hold of the Dominion mind, and that it has been adopted by all of them, for limited classes of goods only, but with success in each class. A reply was not expected nor received from the body addressed, but individual members of the Conference expressed themselves as favourably impressed, and the Minister of Finance, Union of South Africa, declared to the Conference that South Africa "proposed to change from *ad valorem* to specific duties." The matter was followed up by offers of assistance to the Dominions by the Association, which is prepared to submit comparative tables showing the estimated effect on revenue of the proposed change; and it is interesting to note that amongst the official resolutions adopted by the Conference is one which "reaffirms the principle that in all Government contracts *effective preference* shall be given to goods made and materials produced within the Empire" . . . and that "so far as practicable efforts be made to ensure that the materials used in carrying out contracts be of Empire production." It follows that whatever differences there may be in methods proposed for arriving at effective preference there is no question that there is a desire to give it.

The memorandum dealt with many other matters affecting export trade, in particular with the desirability of all the Dominions and Colonies adopting a common form of declaration for Customs duty, and it is gratifying to see a resolution to that effect on the official Summary of the Conclusions of the Conference (G.) (i).

The subject of exact conditions of contract is, in the minds of those Dominions which import British goods in a large way, now beginning to rank in importance even with subjects of immediate interest like prices, deliveries, tariffs, customs formalities, etc. This is all to the good; and it brings out the correctness of the Association's attitude at home in giving to the subject of exact conditions an importance equal to and even greater than that of any other branch of commercial intercourse. The daily Law Reports show how frequently loose conditions bring down the seller in other branches of British industry, and how very rare it is to find a B.E.A.M.A. firm maintaining its rights in this respect in a Court of Law. The Export Committee, working hand-in-hand with the Overseas Committees, has had a busy year in endeavouring to fix on the one hand special conditions for specific contracts, and, on the other, by fixing a standard set (which is of vastly great importance) to enter the blissful region of previously agreed conditions which not only saves time and worry but renders both purchaser and seller practically immune from dispute or differences of any sort. India, Australia, and South Africa provide examples of effort in both directions, and the concurrent co-ordinating effort of the Export Committee towards fixing model texts of conditions suitable for all overseas countries will, it is hoped, ultimately bring both sides to an appreciation of their common interest in this matter.

The Agent-General for Tasmania approached the Association asking for assistance towards equipping the Engineering Laboratory of the University of Tasmania, Hobart. The

appeal to members resulted in the presentation free of a complete sixty-cell battery, motors, starters, etc., with an offer of a variety of other apparatus at a nominal charge.

Through committees support was given to a protest sent to the Foreign Office against the tendency of consuls of many countries to increase very considerably their consular charges for *visés*.

The headquarters of the Australia Overseas Committee has been moved from Melbourne to Sydney, as the centre of gravity has gradually been transferred to Sydney.

The report naturally refers at some length to the British Empire Exhibition, and to the hard work that the B.E.A.M.A. put into the organisation of the electrical and allied section during 1923. The equipment of the power station and some of the main exhibits of which we have already given particulars, are summarised and the section closes thus:—

"The whole Electrical and Allied Engineering Section is one which should do much to further the application of electricity in all directions and lead to increased acceleration in the development of the industry, the upward tendency of which is already well marked."

The arrangements for the World-Power Conference are also summarised. The National Committees in each country are financially self-supporting, and already have collectively a membership of over 500. Preliminary particulars of 250 papers have been received.

Arrangements are being made to ensure the comfort of the delegates both at Wembley and in London, and a special committee has been formed for this purpose. Accommodation and travel facilities are being arranged by official travel agents for the Conference. The celebration of the first centenary of the birth of Lord Kelvin, which is being arranged by a Committee of the Royal Society, will take place during the second week of the Conference. The B.E.A.M.A. Director accepted the interested institutions' invitation to act as Hon. Secretary to that Committee.

Three official tours are being organised to follow the Conference, the members of which will visit places of interest and works in Great Britain, France, Italy, Switzerland, Norway, and Sweden. These tours will run concurrently, starting almost immediately after the Conference.

The report proceeds to refer briefly to work done in connection with revised railway classification of merchandise, and relating to schedules of standard railway charges. In the latter case it is stated that each of the four railway groups issued, in July, 1923, schedules of standard charges which they proposed to apply to all classes of traffic by merchandise and passenger trains and to season, traders', and workmen's tickets. After very careful consideration the Traffic Committee recommended the Council to lodge objections to practically the whole of the schedules. This will involve appearing before the Railway Rates Tribunal in opposition to the companies' proposals, and a large amount of data has been prepared by the Traffic Committee for this purpose. The traders' case generally will be prepared by the Traders' Co-ordinating Committee, upon which the Association is represented, and it will be necessary to raise a fund for legal expenses; an appeal has been already issued.

Reference is next made to the general reduction of railway rates since the last report, and mention is made of standard terms and conditions of carriage.

The negotiations between the B.E.A.M.A. Committee and the L. & N.W. Railway Co. in connection with the construction of special vehicles to carry single pieces weighing up to seventy tons, are not yet concluded, mainly owing to the absorption of the L. & N.W. Railway in the L.M. & S. Group. This has necessitated reopening the question with the Group, who are considering it on a much broader basis, as it will now be essential to take the Scottish lines into consideration. Designs for special trucks to carry both 70 tons and 100 tons have been submitted to the Committee by the Group, but the difficulty of keeping the loading plane sufficiently low to bring such large pieces within the limits of the railway gauge imposed by bridges, tunnels, etc., is causing considerable delay in carrying out this important project. Meantime many heavy pieces have to be transported by road, and the Committee has compiled a list of hauliers in various industrial centres who can deal with this special class of traffic.

After brief reference to shipping rates and charges, British ocean freights which are still so high as to handicap export trade, and to the high cost of consular fees, the Council reviews the progress of researches made by the E.R.A.

The study of insulating materials still occupies the first place and will probably continue to do so. The heat resisting properties of fibrous and composite materials are now engaging chief attention, while the improvement of asbestos materials and the development of cellulose acetate products are presenting new lines of study which are being actively followed with the assistance of the chief manufacturers concerned. The research on insulating oils has already resulted in the publication of a B.S.S. specification, and has brought out new problems in the mechanism of insulation breakdown with different classes of oil impurity. In almost every direction in which the study of dielectrics has been pursued, phenomena have been observed which cannot be accounted for. It is hoped to bring into co-operation scientific workers in allied fields so that an attack may be made on a much wider front than hitherto.

A report has been issued during the year with tables giving the safe loadings for British standard paper insulated cables for service up to 11,000 volts.

The research on overhead line material has resulted in an application for a patent on a new design of pole; while overhead conductors, single and stranded, copper, aluminium, steel, and steel-cored aluminium have been the subject of reports. Wind pressure and velocity and the stresses to which lines may be subjected are now receiving attention.

The research on electric control has developed along new lines and brought out features of unexpected importance.

The research on steam nozzles has made good progress, the second report being presented as a paper before the Institution of Mechanical Engineers and the third being well forward. The research into the specific heat of superheated steam at high pressures and temperatures is now proceeding, and has been linked up with a corresponding research being carried on elsewhere.

The broadening of the basis of membership of the E.R.A. so as to secure the support of the supply side of the industry and that of large users of electricity, was successfully accomplished during 1923, and most of those outside supporters who contributed towards the important researches on electric control have now been enrolled as associate members of the E.R.A.

Turning to the question of standardisation, over twenty standard electrical specifications were published during 1923. Of outstanding interesting is the publication of B.S.S. 168 for Industrial Motors and Generators, which supersedes—so far as industrial motors and generators are concerned—the classic E.S.C. 72/1917, and definitely establishes for the first time as a British standard rating the long-established practice of British manufacturers in providing a substantial margin of power (overload) on the standard full-load rating, besides standardising the recognised practice of limiting to 40 deg. C. the temperature rise for continuous full-load rating. Following the meeting in Geneva of the International Electro-Technical Commission, mentioned in the last report, a conference was held in London between the Dynamo and Motor Sections and the American delegates to the Geneva meeting for the consideration of reasons for the adoption of the British standard rating. Since then the Electric Power Club of America has published in its standards, as recommended practice, for certain types of machines, the load-*plus*-overload rating with a 40 deg. C. rise for the continuous full load. It has now been decided to issue separate specifications for turbo-alternators, large machines, rotary converters, and transformers, and the Standardisation Committee and the interested sections are at work on separate drafts for these classes of machinery.

As a consequence of the issue by the B.E.S.A. of separate specifications for electrical machinery and switchgear, many of the B.E.A.M.A. *Standardisation Rules* have been superseded by B.E.S.A. standard specifications, and the Standardisation Committee is engaged in revising and amplifying the remaining B.E.A.M.A. *Standardisation Rules*.

Other important work is proceeding on the standardisation of Diesel fuel oils and lubricating oils, non-ferrous alloys for electrical purposes, switchboards, &c.

At the request of the Standardisation Committee, the B.E.S.A. has set up a panel to prepare a specification for fractional-horse-power motors, and a draft, prepared by a subcommittee of the Dynamo and Motor Section, has already been submitted as a basis for discussion.

The Gas, Oil, and Diesel Engine Sections are collaborating at the present time with the B.E.S.A. in drafting specifications for internal combustion engines. In connection with these specifications the E.R.A. has, at the request of your Standardisation Committee, carried out tests to determine the maximum degree of cyclic irregularity which can be permitted in the engine to prevent objectionable flicker in lamps.

The same sections, after consultation with some of the chief fuel-oil producers, drafted and put into provisional use a specification for fuel oil and forwarded it to the B.E.S.A. to serve as a first draft in the preparation of British standard specification for fuel oil.

The extent to which B.E.A.M.A.-B.E.S.A. co-operative work has grown will be gathered from the fact that there are on B.E.S.A. committees and panels over 120 B.E.A.M.A. representatives, the great majority of these not being resident in London.

A new set of conditions for repair and overhaul work was issued during the year, and has been adopted by the Dynamo and Motor, Rotary Converter, Turbo-Generator, and Pump Sections.

The text of the export set of conditions referred to in the last report met with some opposition in the I.E.E. Council, and was referred back to the Joint Committee of revision. It was decided, under expert advice, to re-present the work in another form; and it is now being reconsidered by the Joint Committee, and may possibly be ready for issue by the I.E.E. before the present year closes.

A similar explanation of delay applies to the proposed I.E.E. short set "without erection" for home use.

The F.B.I. recently announced that it had had some little success in its attempt to get the Government Departments to adopt an independent arbitration clause. Terms of settlement stated to have been made with the War Office, Admiralty, and Air Ministry are as follows:—

"In contracts for general stores a clause should be inserted providing for arbitration *in the event of rejection of goods*;

the arbitration to be carried out by two independent arbitrators appointed by the Departments and the contractor respectively or by their umpire. *Exception is made, however, in the case of certain classes of technical war stores not of a commercial character.*"

The B.E.A.M.A. Revising Committee, by which most of the labour on Association texts is done, records its sense of loss in the death of the late Mr. J. A. Phillips.

The Council granted fifteen scholarships during the year, two in electrical and mechanical engineering, seven in electrical engineering, and six in mechanical engineering. The class of candidates coming forward has shown consistent improvement since the initiation of the scheme, and amongst those presenting themselves for this year's awards is a candidate who is combining his reading for the mathematical tripos with special work in electro-magnetic theory, and another specialising in metallurgy with special reference to engineering.

The number of overseas students in members' works at the close of the year was 125 according to the returns received, an increase of 25 on last year's return. The countries sending the largest numbers were (in order of numbers): India, Australia, Africa, South America, Egypt, and China.

The past year's trade has not been such as to give encouragement to plans for the reception and training of overseas students on a considerable scale, and this cherished project of the Committee has suffered a further postponement.

Statistics showing in what way foreign industrial countries manage this important matter of the training of their overseas students have been before the Committee during the year, but are not yet sufficiently complete to warrant publication. It may, however, be said that they indicate the necessity for members accepting as many overseas students as they can possibly accommodate if this country is not to be left without English trained engineering purchasers abroad, including our own Dominions.

The Electrical Development Association reports a further large increase in its total membership, from 691 to 1,166, the membership of the four main classes now standing as follows: Municipal undertakings, 97 (last report, 87); company, 85 (79); manufacturers, 244 (296); contractors, &c., 740 (229); total, 1,166 (691). The drop of 52 in the manufacturers' class results from a regrettable error in last year's figures which a careful scrutiny disclosed; but it is more than compensated for by the large increase in the contractors' class, from 229 to 740.

Increase in membership points to increase in usefulness and prestige, and the E.D.A. has during the year won increased recognition from the Press, the learned institutions, and leaders of opinion, and has extended the scope of its operations in various directions.

The non-obligatory standing rule of association, defining the trade custom in the matter of cash discounts, which has stood unamended since 1912, was amended by the Estimating and Accounting Committee during the year. The rule, now, for the first time, names the two rates of discount commonly called "cash," and sets out the conditions under which they should be allowed. The Committee is at present engaged on an exhaustive analysis of cost-accounting, towards the preparation of a draft for consideration by the sections.

During the year, having regard in particular to members' large commitments at the British Empire Exhibition, the Council amended the Exhibition standing rule so as to prohibit members exhibiting at any exhibition without permission.

The Council, at the invitation of the Institution of Electrical Engineers, gave its approval to the founding of a national registration authority for electrical contractors, and became a guarantor of £100 towards the creation of that body which was duly incorporated.

The founders and shareholders (F.B.I., B.E.A.M.A., C.M.A., B.E.A., and E.L.M.A.) of Industrial Publicity Service, Ltd., decided during the year to accept an offer by the directors for its purchase on favourable terms. "The agreements for purchase provide that the present holders shall remain in complete control until the conditions of the purchase agreements have been carried out. The new arrangement places the I.P.S. in the field as an undertaking competing for publicity work and general advertising, unhampered by any restrictions; and the subsidiary company, Industrial Intelligence, Ltd., which was organised for general propaganda on behalf of British industry, has been wound up."

Lords Aberconway, Invercairn of Strathnairn, and Weir, Sir Robert Hadfield, Sir George Sutton, and Mr. W. Rutherford have become vice-presidents of the B.E.A.M.A. for the session 1923-24.

The number of members at the end of the year was 181. Nine new members were elected.

The number of meetings, necessitated by the various activities of members of the Association, held during the year, was nearly 1,000.

Electricity Supply in Morocco.—La Société de l'Energie Electrique du Maroc is the name of a new company which has lately been formed in Paris (280 Boulevard Saint Germain), with a capital of 10 million fr. to undertake the supply of electricity for power purposes in Morocco.

The British Electrical Development Association (Inc.).

Annual Luncheon.

ON Friday, March 21st, the annual meeting of the British Electrical Development Association was held, and was followed by a luncheon at the Hotel Cecil, at which there were present some 260 members and guests. The newly-elected President, Ald. W. Walker, occupied the chair, and after the loyal toast proposed "The British Empire Exhibition." He said this year would be notable above all others for the holding of the great Exhibition, at which no industry represented would show greater progress than the electrical industry. Although the "Electrical Age" had dawned, the man in the street had no conception of the extent to which he was indebted to electricity in the course of his daily life. The credit of the British Empire was at stake, and they must see that the Exhibition was a success—as it undoubtedly would be. "E.D.A." had been working quietly but well, and its exhibit would do credit to the industry. He regretted that although it meant so much to British industry, the workmen's trade unions and organisations had taken no part in the Exhibition scheme; that showed a want of conception of the great realities. Ald. Walker, although a Free Trader, entered an emphatic protest against the attempt that was being made to use the Exhibition for political propaganda; no party had the right to make use of it as a means of advertising its views.

SIR JAMES STEVENSON, G.C.M.G. (Chairman of the Board of the Exhibition), responded to the toast; referring to the chairman's use of the initials "E.D.A.," he suggested that the Association would become better known if it used its full title more often. He deprecated journalistic scares as to whether the Exhibition would be ready by the opening day, and expressed regret that the men who invited him to take charge of the undertaking did not attend the debate in the House of Commons and vindicate their nominee. The Exhibition had nothing to do with politics. It would not only appeal to the people who came to see it, but also to the millions abroad who could not be present. Already there had been a tremendous response; a thousand excursions from the Provinces had been arranged, and those who wished to bring their employés up to visit it must be quick, or they would find it difficult to book a vacant date. It *must* be opened before April 26th (the date of the football final), as the Stadium could not be opened without the Exhibition, hence the opening had been fixed for April 23rd. The success or failure of the project meant a great deal to the future of the British race.

SIR MALCOLM MCALPINE, K.B.E., proposing "The Electrical Industry," was glad that that Association was in operation, as there were many potential users of electricity who were quite ignorant of the help that it could give them. He had borne considerable responsibility in the construction of the Exhibition buildings; 14,000 to 16,000 men were on the ground when the building trades were busy, and an outstanding feature of the undertaking was the way in which the trade unions dealt with the work. There was no labour trouble of any kind—largely owing to the way the men were led. Every man who had a grievance knew that it would be dealt with by one of the partners of the firm. The Association might do much to educate the potential buyer; it was of immense importance to users of power to know how it could be economically produced and efficiently used. In South Africa, when doubts were expressed as to the use of taking part in the Empire Exhibition, he gave an interview to a representative of the *Cape Times* and showed that South Africa had innumerable goods that other parts of the Empire needed, and the Exhibition should be looked upon as a shop-window for the Empire.

Responding, MR. E. GARCKE said the electrical industry was a happy combination of theory and practice. Nothing great or good in this world was accomplished without industry or service, and it was the duty of every man to serve his fellows. They should teach the public how to think and act electrically. The reorganisation of electricity supply had not put up prices against the consumer; the improvement in its commercial aspect was the result of the better organisation. The comparatively low Continental prices were due to a lower standard of living, combined with our higher taxation; they should support home industries, or they would cut away the roots of the growing plant on which the next generation would depend for sustenance.

MR. S. T. ALLEN, chairman of the council, also responding, said history showed that in a great crisis some great invention cropped up which gave the world a new lease of life. The present great developments were wrapped up in electrical transmission of one kind or another—communication, power, traction, &c.—and it was probable that the applications of electricity would help to bring about new and better conditions. That Association was acting for an industry with a capital of 200 million pounds, and all sections were imbued with the same purpose—to further the uses of electricity to universal adoption, and thereby to effect changes which would settle some of the great problems which troubled the community. The Association's aims were to educate the public,

to cheapen industrial processes, to purify the atmosphere and benefit health, to eliminate unnecessary drudgery. They were deeply indebted to the director of the Association, Mr. J. W. Beauchamp, and his staff for their wholehearted labours, to which the Association owed the high reputation which assured its future prosperity.

Oil Engines.

By CHARLES DAY, M.Sc., Wh.Sch., M.I.E.E.

(*Abstract of paper read before the* IRISH CENTRE *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE author deals with the subject from the point of view of a person who desires to install power plant and wishes to consider alternative types. The expression "oil engines" is interpreted as meaning engines which use heavy oils as their fuel, in practically all of which the oil is sprayed direct into the cylinders at, or near, the end of the compression stroke, whilst with engines of the petrol type the oil is carried into the cylinders during the suction stroke along with the air which is drawn in by the piston.

For small electricity stations steam plant has proved very uneconomical, and the high working cost has created a general impression that small electricity supply stations cannot compete with large stations, but when oil engines are used the position of the small station alters very much.

When it is desired to start a supply of electricity in a district wherein the demand may eventually become large enough to justify a steam station, but at the commencement is not large, the adoption of steam at the outset would result either in the cost per unit to the user being very high during the first few years, or in heavy loss to the station if the electricity were sold at a price satisfactory to the user, whereas a satisfactory price to both supplier and user is practicable from the commencement if oil engines are installed. Another point is that if steam plant is installed at the commencement, the power station must be designed on large lines, thus causing heavy initial capital expenditure.

At the Letchworth electricity supply station there are Diesel engines and steam turbines, the steam plant showing the highest thermal efficiency in Great Britain for its size (classification H). Mr. C. Gould, chief engineer, states that with the steam plant the fuel cost per unit is .47d. with the plant running at a practically steady load of ⅞ths of its rated load, whilst with the Diesel plant the fuel cost is .36d. with a load factor of approximately 60 per cent. The relative costs per ton of coal and of oil at Letchworth were in 1923 in the ratio of 1 to 4.43.

Mr. Howes, the chief engineer at Harrod's stores, London, has supplied the following information regarding the operating cost of Diesel engines:—

Load factor	25 per cent.
Fuel cost	0.3d. per unit
Wages	0.172d. ,,
Lubricating oil, stores, and sundries	0.038d. ,,
Total operating costs	0.510d. ,,

When obtaining electrical energy from a distant station, substantial cable losses and heavy capital expenditure on cables must be allowed for, whilst the risk of malicious or accidental interference with long cables must be seriously reckoned with. Coal miners' strikes must also not be looked upon as remote possibilities.

Mr. N. A. Buch recently showed in a Swiss technical paper that even in Switzerland, with her extraordinary water supplies, it is economically advisable to use heavy-oil engines in many cases for the following reasons:—Water power stations, except where very favourably situated, even in Switzerland necessitate a capital expenditure per kW which is two to three times the cost of an oil-engine station; the capital cost for cables is relatively very high, as are also the transmission losses. Further, a water-power station must, at the commencement, be designed for the maximum power it has to generate, whereas an oil-power station can be built up in stages as the demand develops.

In small electricity stations which supply mainly lighting, the load on the plant is, for a very large proportion of the hours in each year, much below its capacity; also the actual power required from the station at any time is seldom definitely known beforehand. For such conditions oil engines are particularly suitable, as they can be started up at a moment's notice, whereas steam boilers have to be kept in readiness, causing high standby losses.

The paper by Mr. K. B. Woodd Smith and Mr. T. D. Key, of Alexandria, Egypt, which was recently read before the Diesel Engine Users' Association, relates to pumping plant at Alexandria, where steam- and oil-driven pumps of similar size are working alongside under similar conditions and are, therefore, definitely comparable. The paper shows that the large saving of £13,000 for the year resulted from the use of the Diesel engines, their average fuel consumption for the year being .318 lb. per i.h.p., and Mr. Bennett, Chester Waterworks Co., stated that the figure coincided with the result obtained at Chester over considerable periods of running of similar engines, while Mr. Wyville stated that his company's experience of changing from steam to Diesel engines for driving its engineering works showed a saving of 43 per cent.

Oil engines of 6,500 b.h.p. are being made, but as yet they must be looked upon as quite experimental. For land purposes reliable engines of well-proved designs are obtainable up to 1,500 b.h.p. The two-stroke cycle is adopted for engines of small power, where cheapness is essential; also largely for engines of 1,000 h.p. and upwards, especially if run at a low speed.

The four-stroke cycle is very generally adopted for engines up to 800 or 900 b.h.p., the fuel consumption of small engines being substantially lower with the four-stroke cycle, but of large engines (for instance, 1,000 b.h.p.) it is practically alike with both cycles.

In future there will be a tendency to increase the number of cylinders in preference to using fewer cylinders of larger power. An 800-b.h.p. engine with eight cylinders would weigh less and cost less than an engine of the same power with, say, three cylinders; it would have practically the same fuel consumption, whilst the upkeep costs would be rather less.

Sewage grease has been used successfully as a fuel; it had to be got out of the barrels with a spade, but when heated it flowed freely enough. Efforts to establish a standard specification for fuel oils might with advantage be left for a little while, for manufacturers are steadily developing engines capable of utilising the more difficult residues. The fuel consumption per h.p. of large Diesel engines is not materially lower than that of small engines, and the low consumption obtained when the engine is new is maintained indefinitely. In many cases the consumption after 10 years' working has been proved to be quite as good as when the engines were new, without any part of the engine or of the spraying device ever having been renewed.

For pumping the circulating water centrifugal pumps are the cheapest and simple, but reciprocating pumps are to be preferred.

As regards vibration, a single-cylinder engine even with balance weights is the worst type, and a six-cylinder engine is the best.

United States Electrical Exports in 1923.

Electrical Machinery and Apparatus.

BELOW are shown the values of electrical machinery and apparatus exported from the United States during the twelve months ended December last. Comparative figures are given for the twelve months ending December, 1922, and notes of increases or decreases are added.

	1922. $	1923. $	Inc. or dec.
Direct-current generators.—			
Under 500 kilowatts ...	545,000	788,000	+ 243,000
500 kilowatts and over ...	990,000	753,000	− 237,000
Alternating-current generators.—			
Under 2,000 kilowatts ...	197,000	127,000	− 70,000
2,000 kilowatts and over ...	1,398,000	1,284,000	− 114,000
Accessories and parts of generators	1,136,000	1,025,000	− 111,000
Self-contained lighting outfits	442,000	610,000	+ 168,000
Batteries.—			
Primary	1,083,000	1,273,000	+ 190,000
Storage	1,474,000	2,344,000	+ 870,000
Transforming and converting apparatus.—			
Power transformers ...	4,159,000	3,195,000	− 964,000
Other transformers ...	747,000	760,000	+ 13,000
Rectifiers, condensers, double-current and motor generators, dynamotors, synchronous and other converters	1,367,000	999,000	− 368,000
Distribution equipment.—			
Switchboard panels, except telephone	2,702,000	1,668,000	−1,034,000
Switches and circuit breakers over 10 amps.	1,892,000	1,796,000	− 96,000
Fuses and fuse plugs ...	199,000	311,000	+ 112,000
Watt-hour and other measuring meters	564,000	519,000	− 45,000
Volt, watt, and ampere meters, and other recording, indicating, and testing apparatus	876,000	1,027,000	+ 151,000
Lightning arresters, choke coils, reactors, and other protective devices ...	678,000	616,000	− 62,000

	1922. $	1923. $	Inc. or dec.
Motors, starters, and controllers.—			
Motors, under 1 h.p. ...	772,000	1,728,000	+ 956,000
Stationary motors.—			
1 to 200 h.p.	2,037,000	3,088,000	+1,051,000
Over 200 h.p.	666,000	813,000	+ 147,000
Railway motors	480,000	660,000	+ 180,000
Electric locomotives.—			
Railway	854,000	3,037,000	+2,183,000
Mining and industrial ...	225,000	277,000	+ 52,000
Other motors	351,000	231,000	– 120,000
Rheostats, controllers, and other starting and controlling equipment	920,000	1,752,000	+ 832,000
Accessories and parts for motors	1,138,000	1,659,000	+ 521,000
Electrical appliances.—			
Electric fans	816,000	859,000	+ 43,000
Incandescent electric lamps.—			
Carbon filament	62,000	62,000	—
Metal filament	1,225,000	1,131,000	– 94,000
Total	1,287,000	1,193,000	– 94,000
EXPORTED TO—			
United Kingdom	9,000	18,000	+ 9,000
Canada	113,000	55,000	– 58,000
Central America	45,000	66,000	+ 21,000
Mexico	235,000	262,000	+ 27,000
Newfoundland & Labrador	13,000	19,000	+ 6,000
British West Indies ...	30,000	27,000	– 3,000
Cuba	144,000	187,000	+ 43,000
Argentina	162,000	98,000	– 64,000
Brazil	46,000	22,000	– 24,000
Chile	45,000	58,000	+ 13,000
Colombia	45,000	37,000	– 8,000
Uruguay	26,000	19,000	– 7,000
Other South American Countries	57,000	44,000	– 13,000
British India	19,000	10,000	– 9,000
China	20,000	14,000	– 6,000
Philippine Islands ...	21,000	9,000	– 12,000
Australia	101,000	109,000	+ 8,000
New Zealand	28,000	16,000	– 12,000
British South Africa ...	70,000	49,000	– 21,000
Other Countries	58,000	74,000	+ 16,000
Other electric lamps ...	206,000	235,000	+ 29,000
Flashlights	254,000	494,000	+ 240,000
Searchlights and projectors	280,000	366,000	+ 86,000
Motor-driven household devices	642,000	866,000	+ 224,000
Domestic heating and cooking devices	597,000	984,000	+ 387,000
Industrial electric furnaces and ovens	238,000	214,000	– 24,000
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries ...	586,000	871,000	+ 285,000
Signal and communication devices.—			
Radio apparatus	2,898,000	3,448,000	+ 550,000
Telegraph apparatus ...	316,000	690,000	+ 374,000
Telephone apparatus, including telephone switchboards	4,391,000	—	—
Magneto telephones ...	—	196,000	—
Other telephones	—	406,000	—
Magneto switchboards ...	—	119,000	—
Other telephone switchboards	—	403,000	—
Railway signals, switches, and attachments ...	685,000	734,000	+ 49,000
Bells, buzzers, and annunciators	64,000	108,000	+ 44,000
Other electrical apparatus.—			
Sparking plugs, magnetos, and other ignition apparatus	1,093,000	1,695,000	+ 602,000
Insulating material ...	889,000	1,435,000	+ 546,000
Metal conduit, outlet, and switch boxes	295,000	478,000	+ 183,000
Sockets, lighting switches and receptacles	489,000	1,077,000	+ 588,000
Other wiring supplies and fixtures	1,342,000	1,891,000	+ 549,000
Other electrical apparatus, n.e.s.	7,887,000	8,822,000	+ 935,000
Insulated iron or steel wire and cable	378,000	687,000	+ 309,000
Insulated copper wire and cable	1,982,000	3,140,000	+1,158,000

The Faraday Society.

The Electronic Theory of Valency.

THE Society continues to interest itself in this subject, and at the February meeting Principal A. P. LAURIE put forward some suggestions for a magnetic theory of valency. Incidentally, the author's conception also suggests a reconciliation between the Rutherford-Bohr atom, with its revolving electrons round a positive nucleus, and the Langmuir-Lewis atom, which postulates stationary positions for the electrons. It will be remembered how brilliantly successful the former picture has been in the hands of Bohr and Sommerfeld in explaining the origin of the spectra series, while the latter theory has been fruitful in the field of chemical action. Neither of these pictures takes into account the known magnetic properties of the atom. Dr. Laurie adheres tentatively to the Langmuir series of rings or shells, but he suppcses the electrons to be themselves moving in tiny orbits round their fixed positions, so that they become equivalent to a magnetic shell, or magneton (atomic unit of magnetism), exercising on one another magnetic forces, while still bound by electric forces to the nucleus. Making the further assumption that in the non-metallic elements the magnetons in the outer shell have their poles in one direction and in the non-metallic elements in the opposite direction, it is easily shown, by reference to the author's diagrams, that combination between two non-metallic elements involves the straining of magnetons, while the stable combination of a metal with a non-metal involves the transference of one or more magnetons from the outer shell of the non-metal to the inner shell of the metal atom. This view of chemical combination is shown to be in general agreement with what we have learnt from the Braggs and others as to the arrangement of atoms and ions inside a crystal. Dr. Laurie further applies his theory to the formation of polymeres of the water molecule and of hydrates, and he is thus led to a theory of hydration in solution and ionisation which seems to get over some of the difficulties of the orthodox theory of dissociation in solution. Finally, Dr. Laurie allows his magnetons, or revolving electrons, not to remain stationary, but to rotate as a whole round the nucleus, keeping step with one another. The atom then acquires the properties of the Bohr type of atom as well as those of the Langmuir type. At the present stage of development no atomic picture can be complete—innumerable problems in organic chemistry, as well as in spectroscopy, must be solved before there can be finality—but Dr. Laurie's conception is undeniably suggestive, and it points the way to a reconciliation of two opposite points of view, both of which are at present necessary, which should yield valuable results as the theory is further developed.

The Electrical Properties of Sols and Gels.

At the same meeting Mr. E. HATSCHEK and Mr. R. H. HUMPHRY drew attention to a curious phenomenon in colloidal physics. Making up an agar-electrolyte system in the state of both solution and jelly (sol and gel, to use the colloid jargon) they carefully measured the electrical conductivity in the two states and found that the conductivity of a gel containing copper sulphate was always greater than that of the corresponding sol at the same temperature, the difference increasing with increasing concentration of agar. Further, the conductivity of both sol and gel was always greater for alternating than for direct current. In the case of soap sols and gels, McBain and his collaborators have shown that the electrical conductivities at equal concentration and temperature are identical. No convincing explanation of these interesting observations was put forward at the meeting.

Electrochemical Properties of Low-Tin Bronze.—In a note on the effect of cold drawing and annealing on some electrochemical properties of a low-tin bronze, presented at a recent meeting of the Institute of Metals, Mr. Stuart H. J. Wilson, B.Sc.(N.Z.), M.Sc.(Vic.), points out that the thermo-electric power of a series of cold drawn bronze wires has been determined. This at first rises and then ceases to do so as the amount of cold work is increased, but with still more work the power again increases. The curves showing the relationship of the thermo-electric power to the amount of reduction in drawing are analogous to those obtained for other physical and mechanical properties. The effect of the drawing operation at different depths in the wire has also been investigated, and it is shown that the wire is very far from homogeneous. On annealing a cold-drawn wire the thermo-electric power at first undergoes little alteration, but at a temperature of 400-500 deg. C. shows a rapid and important increase, thereafter falling to a value lower than that in the cold-drawn condition. Measurements of the electrochemical potential show at first a marked rise to a maximum as the wire becomes more and more worked; they then fall to a minimum, and finally rise again.

Transport by Road and Rail.

Future Developments.

The annual joint meeting of the local centres of the Institutions of Civil, Electrical, and Mechanical Engineers took place at Birmingham on February 14th, when the relative advantages of transport by road and rail, with special reference to future developments, were debated.

Mr. E. C. Trench (chief engineer, London, Midland and Scottish Railway), opened the discussion by saying that the cost of main road maintenance around London, for some little distance, varied from £700 to £980 per mile, a higher figure than for the average road throughout the country. The cost of railway maintenance, on the London, Midland & Scottish Railway for example, was about £1,000 per mile, but that figure included sidings, goods yards, engine sheds, stations, and everything connected with the railway. Restricting the outlay to the track, the cost was about £600 per mile. There was room for both methods of transit; both could be mutually helpful, provided they stuck to their proper jobs. They needed a system to supply every national requirement and each section required the assistance, as well as the control, of Parliament to bring it to the highest state of efficiency.

Mr. H. H. Humphries (city engineer and surveyor, Birmingham), pointed out that all forms of transport must gradually be combined into one co-ordinated system, in which each part would carry out duties which it was best fitted for. With the establishment of large electricity supply stations throughout the country, it might be possible that road vehicles could be cheaply driven by electricity, with re-charging stations, &c., along the main traffic routes. Far too little attention appeared to be paid to the running of railway sidings through suitable areas in such a way that branches could be taken into works and factories so as to enable direct loading to be effected.

Sir Henry Fowler (chief assistant mechanical engineer, London, Midland & Scottish Railway), said that the old price of petrol worked out at about ½d. per ton mile on the road. On his section of the railways the coal used was .069 lb. per ton mile, and that figure had since been beaten. One sixteenth of a 1d. as compared with a halfpenny used in other traction. The railways would always remain as the removers of bulk traffic, whether of goods or passengers; a larger amount of goods traffic was going to the railways which constantly made improvements. Locomotives were embodying the turbine and electricity generator, and he thought there was a future for them.

Professor Burstall explained certain general principles from which he made some deductions with reference to future progress. To begin with, he did not believe in competition in these matters, but in co-operation. The surface of the roads, at any rate as they had been worked out at present, were very defective. The petrol vehicle was approximating to a remarkably sound mechanical job, but it had one terrible defect, *i.e.*, the petrol itself. For one country to depend upon another for its raw material in such an important matter as traction was profoundly wrong, and that there was no alternative was a profoundly mistaken idea; he hoped Sir Henry and others would not go in for oil burning. If it were possible to devise a cheap and efficient coal-burning, steam-propelled, road vehicle the whole position would be altered, except that both for speed and density it was not possible ever to equal the "iron way." It was either the mono or double rail upon which mankind must depend. Did they not think it was time they got together and tried to see not merely the virtues in their own system, but the virtues in other systems? Co-operation was the secret of the future.

Sir Philip Dawson, M.P., said he thought that transport by road, canal, or by air, must be co-ordinated with rail transport if the best system was to be devised. As to the improvement of railways he believed they were on the eve of very great developments. Electrification was done under the stress of competition, which from omnibuses and tramcars had become acute. It was difficult to bring home to the railway companies the idea that a large amount of their long-distance passenger traffic might be filched from them unless they adopted improved methods. It could not be denied that in consequence of railway grouping the electrification of railways had been postponed for a considerable period. Some time ago it was stated that the Great Eastern Company intended to electrify its suburban system around Liverpool Street station, but he understood that the scheme had been postponed, and that nothing in that connection might be expected for some time. He believed it was true to say, too, that the postponement of the proposal by the North-Eastern Co. to electrify its main line from York to Newcastle was due to amalgamation and the same reason might, he thought, be given for the deferring of the idea entertained by the London, Brighton and South Coast Co. to electrify its suburban system and main lines to Brighton and, possibly, as far as Hastings. Whether such work would be done was still in the lap of the gods. He recognised the early difficulties associated with amalgamation, and that some time was necessary for due consideration of methods of working under the new regime. At the same time he thought it could not be denied that railway companies were, on the whole, very conservative in their views, though far be it from him to blame them for that. Electrification gave better service from the point of view of suburban traffic. Concerning the future development of main-line railways, it was to be regretted that people were not as well informed as they ought to be with regard to the results that had been obtained in other parts of the world. Europe, where the conditions obtaining more closely approximated to those in this country, had 6,000 kilometres of railway routes electrified, or in course of electrification, and 9,200 kilometres represented projects, while the number of locomotives operating or under construction was 1,400. That electrification had only been successful where either mountain ranges had to be traversed, or where large water power was available and where coal was difficult to get, was quite an erroneous statement. The Leipzig scheme gave a return of 15 per cent. on the capital after allowing for maintenance, depreciation, interest, and depreciation of the distributing system. Concerning the proposed line from London to Brighton, it was shown two years ago, by figures agreed to by officials of the company and himself, that such a return from electrification would be given and that estimate was later supported by engineers from the Continent. When comparisons were made between steam and electric traction several important items were often left out of consideration as applying to the latter. Great saving was affected by reason of the fact that it did away with pumping, water towers, purifying stations, coal and ash handling plant, and with much transportation of coal to various depôts. Turntables would also be dispensed with, and in crowded centres important economies of space would be effected. It had been estimated that a palatial hotel could be built over Liverpool Street station if steam were done away with, thus releasing land, the capital value of which would represent five million pounds sterling. Again, with steam traction there were seven speeds between Newcastle and York; by electrification the figure could be reduced to three. The mileage per hour would be considerably increased and, at the same time, the cost per ton mile would be considerably reduced. It would be good policy to spend fifty millions sterling on electrification because the work involved would go a very long way in saving the payment of doles. What was essential at the present time was big scale operations in matters of that kind.

Mr. Jackson spoke of the uses of electrical transport in the collection of house refuse. Birmingham had, he said, with perhaps one exception, the biggest fleet of electric vehicles in the country; 57 were employed collecting refuse in the city, purchased at a capital cost of £68,473, besides petrol and steam wagons, none of which, however, was used for the collection of refuse. Birmingham did not adopt electric vehicles with a view to a reduction in transport costs, but rather to prevent such costs increasing when in 1919 it was decided to reduce the working hours of the workmen in the salvage department from 54 to 47 hours per week. The department also introduced a new system for controlling the collection of refuse which would have been absolutely impossible with horse haulage, except at a prohibitive cost. With "electrics" it was possible to collect three loads per day, the distance travelled averaging anything from 15 to 25 miles per day. With horses it would have meant not more than two loads per day in those areas more than one mile from the depôts.

The citizens were very good in supplying them with very good cheap fuel, which, incidentally, they might use to better advantage in their own houses. With this fuel they ran their generating plant, produced electricity for driving the motors, lighting the depôts, and charging the vehicles' batteries, so that each householder paid twice for collecting his own refuse.

The vehicles had given entire satisfaction, and during the twelve months ended December 31st, 1923, the percentage of days worked reached the high-water mark of 96.46 per cent.

Birmingham was the first town in the country to acquire an electric trailer, which would be put into use within the next few days; there might be great possibilities in such a method of transport.

The electric vehicle was running at about the same price per ton as the horse, with the horse travelling a distance of eight miles per day, whilst the electric vehicle travelled approximately twice that distance.

Mr. Richard Humphreys, in opening the general discussion, pointed out that electric tramways had been ignored in the debate; but they could show both the advantages of the rail, about which Prof. Burstall had spoken, and of the road. Tramways had not been given a fair show; but they could still keep their end up. The burden of road maintenance in future had got to be shared among all users of the roads, and when that time came electric traction would have a new lease of life.

Mr. George Lanchester (speaking for automobile engineers) said that their branch of the transport services had been spoken of very severely. He could only plead that it was a very young industry. Every speaker was agreed that the necessity was for co-operation, and the fact that automobile engineers had been invited to that gathering was a good omen for the future.

Prof. F. C. Lea (Civil Engineering Department, University of Birmingham) thought it would be necessary to consider the arrangements of main-line railway sidings in and near works to ensure the easy handling of goods. It would be better to develop in that direction than in the direction of road transport. He very strongly favoured the independent sleeper track for the tramways. An iron rail to run upon would always be cheaper than heavy motor traffic for taking people out to residential areas. Was the Birmingham policy of improving roadways largely in order to provide work for the unemployed right? Would it not be better to expend a substantial sum on electrification, or in perfecting the railway system, thus employing large numbers of skilled workers?

Prof. W. Cramp (Electrical Engineering Department, University of Birmingham) observed that any system of goods distribution which was tied to a particular road was bound eventually to disappear. That would mean that every vehicle must ultimately carry its own source of power. Therefore, was the motive force necessary to be supplied by the electric accumulator or mechanical power, such as petrol storage? Weight for weight, the tin of petrol had it easily. They must look forward to some electrical process for the storage of energy in its most economical form. Development would be along electrical storage lines.

Major Thompson said that a large haulier in that district had hauled with a steam wagon and trailer a full load 78 miles with only 3 cwt. of the best Welsh coal.

Major Cook (Ministry of Transport) said there could be no competition between the railways and the roads; each, surely, had its function to fulfil, and was entirely complementary to the other.

Mr. H. H. Humphries thought all the speeches tended to one end, namely, that all kinds of transport must work in conjunction with each other.

The Chairman, in closing the debate, said they could not afford the time lost on goods transported by canal. Were they not getting a bit sick of town planning? The motor-car was opening out the countryside. Surely they should look upon motor-cars as transport feeders until they could afford tramways; and then tramways until they could afford a railway service. He hoped it would not be long before some of the English railway companies took up in real earnest the question of electric traction. They would find it paid just as other countries had done. Electrification of railways would give them a higher average speed, and that was what they wanted.

The Electrical and Engineering Exhibits at Wembley.

Preliminary Notices.

(*Continued from p.* 479.)

The British Electric Plant Co., Ltd. (Alloa), is showing turbine pumps, totally-enclosed a.c. motors, open-protected motors, &c.

The Sterling Telephone & Electric Co., Ltd., will exhibit a great deal of telephone apparatus, mine-signalling systems, and radio apparatus.

The Mullard Radio Valve Co., Ltd., will show many types of transmitting and receiving valves, silica valves, radio accessories, and a "Holweck" molecular pump.

W. T. Henley's Telegraph Works Co., Ltd., intends to display samples of cables (up to 60,000 V.), protective systems, distribution accessories, the "Henley" wiring system, &c.

The Electric Heating Co.'s (Croydon) display will consist of electric fires, hotplates, irons, kettles, and other domestic appliances.

Messrs. Thos. de la Rue & Co., Ltd., will have a collection of insulating materials, and manufactures thereof, for electrical purposes.

Lodge Plugs, Ltd. (Rugby), will exhibit ignition plugs for various applications.

The British Lighting & Ignition Co., Ltd. (Birmingham) proposes to exhibit examples of its stationary-armature magnetos, coil ignition sets, and lighting sets for automobiles, trains, &c.

W.A.I. Coal Cutter, Ltd. (Bradford) will have two electrically-driven coal-cutting machines on its stand, one of the chain type and the other of the disk pattern.

Electrical Utilities, Ltd., is exhibiting electric heating and cooking apparatus, current limiters, and an ignition controller.

The Electric Construction Co., Ltd., is erecting a 400-kW generator, driven directly by a Paxman-Lentz engine, in conjunction with a static balancer. The machines will be connected to a flat-back type switchboard.

Messrs. Davey, Paxman & Co., Ltd. (Colchester) are showing a 500-kW generating set consisting of an E.C.C. dynamo driven by a Paxman-Lentz, positive valve gear engine.

The Paxman Locomotive Valve Gear Co., Ltd. (Colchester) is to exhibit models showing the application to locomotives of the Paxman-Lentz patent cylinder, and valve gear, &c.

The Union Cable Co., Ltd. (Dagenham) will have an exhibit consisting of cables for power, lighting and telephony.

The Watford Electric & Manufacturing Co., Ltd., is arranging examples of its motor-control gear, including automatic starters, contactors, &c.

Messrs. James Keith & Blackman Co., Ltd., are to show fans of many patterns, gas apparatus, and steam and gas air-heating units for ships.

Brookhirst Switchgear, Ltd. (Chester) will display d.c. and a.c. motor control gear, both automatic and hand-operated.

The Pacific Cable Board is organising a display of working apparatus for submarine cables, which will include a Cox selenium magnifier.

The London Electric Firm's (Croydon) exhibit will consist principally of searchlights. There will also be flexible couplings, worm reduction gear, lamp-lowering gear, &c.

Rotax (Motor Accessories), Ltd., is exhibiting automobile electric lighting, starting, and ignition equipment, as well as non-electrical accessories.

Messrs. Newtons (Taunton) are to show small motors and parts for various services.

Messrs. S. G. Brown, Ltd., are to exhibit the "Brown" gyro-compass, electro megaphones, and a variety of radio equipment.

Wilkins Wire & Wire Ropes, Ltd. (Eastwood) will display samples of ropes, including a case exhibited at the 1851 exhibition, and a model cable suspension bridge.

Messrs. J. & E. Hall, Ltd., are erecting on their stand examples of their refrigerating machinery—CO_2 machines, compressors, &c., much of which will be electrically-driven.

Messrs. Thomas Robinson & Son, Ltd. (Rochdale) are to exhibit separating machinery for treating wheat, roller mills, &c.

Messrs. Daniel Adamson & Co., Ltd. (Dukinfield) will show turbine-driven air compressors, compressed-air motors, Adamson-Rateau impulse turbines, &c.

The Valor Co., Ltd. (Birmingham) is to have a display of oil cookers, heaters, &c.

Messrs. N. Hingley & Sons, Ltd. (Dudley) will show ships' cables, anchors, lifting and mining chains, wrought-iron bars and sections, &c.

Messrs. Thos. W. Ward, Ltd. (Sheffield) are to exhibit machine tools, electrical mincing and filling machines, rails, switches, crossings, &c.

The National Physical Laboratory will have an exhibit comprising testing machines for various purposes, furnace controls, refractories, gauging apparatus, &c.

The Consett Iron Co., Ltd., is preparing a display of steel plates, sections, and joists, hematite pig iron samples, specimens of coal, coke, &c., and silica and fireclay bricks.

The Angular Hole-Drilling & Manufacturing Co., Ltd. (Beeston) will show a portable shearing machine for sheet metals, and spanners of all descriptions.

Messrs. Davis & Timmins, Ltd., propose to show examples of bolts and nuts, terminals, and turned fittings for electrical purposes, and turned parts for many other applications.

The Manor-Powis Coal Co., Ltd. (Glasgow) is to demonstrate the X-ray analysis of coal and exhibit samples of coal, and briquettes.

The Bristol Aeroplane Co., Ltd., intends to show aeroplane engines, as well as models of machines.

The Silver Replating Powder Co.'s exhibit will consist of silver, nickel, and black plating materials, polishing materials, &c.

Messrs. Richard Johnson & Nephew, Ltd. (Manchester) will have a display of iron, steel, and copper wires of all kinds, including cable wire, armature wires, bus bars, trolley wire, &c.

Messrs. Fleming, Birkby & Goodall, Ltd. (Halifax) are displaying leather belting and other leather goods, and will show "Teon" belting running in water and steam.

Messrs. James Walker & Co., Ltd., are arranging a display of "Lion" steam and water packings, and other types of packing and jointing materials.

The Butterley Co., Ltd. (Derby) will exhibit a coal-washing plant driven by a 25-h.p. motor, and two centrifugal pumps driven by 10-h.p. motors.

The British Electrical Development Association's display, which is well advanced, is to be arranged on a section covering 10,000 sq. ft. of area. There will be a complete all-electric house, a bureau and rendezvous, as well as eight stands devoted to the demonstration of all kinds of electrical apparatus. In addition to this the Association, in conjunction with Mr. Borlase Matthews, is arranging a small electric farm in the Exhibition grounds.

Messrs. Worthington-Simpson, Ltd., are showing many types of pumping machinery for oil fuel, circulating water, boiler feed-water, &c. A complete condensing plant for a power station will be exhibited.

The British Engine, Boiler & Electrical Insurance Co., Ltd., is to show working models of power plant, &c.

British Electrical Repairs, Ltd., will exhibit a model vacuum impregnating plant.

(To be continued.)

Legal.

Malcolm v. Marconi's Wireless Telegraph Co., Ltd.

Mr. Justice Acton, in the King's Bench Division on March 19th, heard an action against Marconi's Wireless Telegraph Company arising out of the company's business in China. The plaintiff, Mr. James A. Malcolm, of Victoria Street, Westminster, sued the company for commission alleged to be due under a contract dated July 19th, 1915.

Mr. Henderson, K.C., for plaintiff, said that Mr. Malcolm and Mr. Birchal, who was now dead, were appointed sole agents for the Marconi Company in China from July 19th, 1915, until twelve months after signature of peace and thereafter until the appointment was terminated by twelve months' notice. On all business which the Marconi Company did with the Chinese Government during the continuance of the joint agency the agents were to be paid a commission of five per cent., which should be payable when the defendant company received payment from the Chinese Government. While the agency continued three contracts were made with the Chinese Government. By the first contract the defendants undertook to advance to the Chinese Government £600,000, the Chinese Government giving an order for wireless telephone apparatus to the amount of £300,000, which was to be deducted by defendants from the £600,000 advanced. In fact, therefore, £300,000 in cash was handed over to the Chinese Government and £300,000 worth of goods. Under the second contract there was a loan of £200,000 and sales to the extent of £66,000 for three wireless telegraph stations. By the third contract the defendants and the Chinese Government formed a limited company in accordance with the laws of China whereby those two parties really entered into a partnership. This Chinese National Wireless Company having been formed it received all wireless work for the Chinese Government in China. The Marconi Company held one half of the shares and the Chinese Government held the other half. The profits were divided into three equal portions, of which one-third went to each of the shareholders in respect of their holding of shares and the final third went to the Marconi Company in respect of patent rights which it was handing over to the Chinese company. The main dispute arising in this action was as to plaintiffs' right to commission upon the monies advanced by defendants to the Chinese Government. Defendants contended that that was not business done within the agency. There was another dispute as to the amount of commission plaintiff was entitled to on the sales of goods under the first contract. The contract said £300,000, and plaintiff claimed his commission on that. Defendants contended that that amount was whittled down to £210,000. On the second contract the same question arose, and on the third contract there was the question of paying commission on the amount of the loan. The authorised capital of the Chinese company was £700,000, and counsel was told that £200,000 had been paid up and that £100,000 subscribed by the Chinese Government had in fact been advanced to the Chinese Government by the Marconi Company. In each of the three cases, therefore, there was a transaction of loan in view of business done.

Counsel then read voluminous correspondence relating to the contracts and the hearing was adjourned.

The hearing of the action was continued on March 20th.

Cross-examined by Mr. Jowitt, K.C., plaintiff said that it was well known that to get orders from the Chinese Government payments had to be made to certain persons. The Telefunken Company had paid as much as ten per cent. commission on orders for material for China. Witness was not surprised that twenty-two wireless telegraph sets which the Marconi Company was supplying to the Chinese Government at £1,100 each c.i.f., went out as costing £1,300 each c.i.f., the difference representing payments that went to certain gentlemen of state, though witness did not think it would be quite as much as that.

Witness said he did not at first claim commission on the whole of the sum of £600,000, half of which was a loan by the Marconi Company. He first claimed it at an interview which he and Mr. Birchal had with Mr. Godfrey Isaacs in November, 1919. After that he did not always insist upon it because he was hoping for an amicable settlement.

On March 21st, Mr. W. A. Jowitt, K.C., for the Marconi Company, said that plaintiffs had never before accepted an order for the sale of materials that was coupled with an obligation to lend money to the purchaser. On the general aspect of the case he found this peculiar result in the case of two agents: that one was able to secure a clear order for the sale of £300,000 worth of goods and received a commission of five per cent., while the other agent got an order for £300,000 worth of goods with the onerous condition attached that £300,000 was to be lent. If the latter was to get a commission twice over that would be a curious conclusion to arrive at. Counsel suggested that to pay five per cent. commission on a loan was a ridiculous amount. No business was done up to the time of Mr. Birchal's death and no business resulted from plaintiff's efforts. The business was done apart from the plaintiff.

Mr. Godfrey Isaacs, managing director of the Marconi Company, gave evidence regarding the contracts. Witness said plaintiff was introduced to him by one of his colleagues. There appeared to be a working arrangement between plaintiff and Mr. Birchal. The company's first scheme was a big one for a loan and the supply of goods to the Chinese Government. Messrs. Birchal and Malcolm were to receive one per cent. on the financial part and 1¼ths per cent. on the business part. Prior to this the company had never lent money as a condition of obtaining an order. The business which was then contemplated did not in fact materialise. Before it fell through, however, witness received a report that the Chinese Government was asking for tenders and as the Germans were then active competitors in China—that was the year 1923—witness was anxious that Great Britain should, if possible, get in there. Witness said he had never heard of a commission of five per cent. in respect of the fixing of a loan. Such a commission would be an impossible one. Defendant company had always been willing to pay that commission to plaintiff's agency on orders received from the Chinese Government, but no orders were in fact obtained through plaintiff's agency.

Witness said his company was doing business in Austria with the Government as large shareholders. The Marconi Company lent money to associated companies in order to assist them in conducting their business. As far as he could remember he had never paid any commission to anybody in respect of money lent. The whole business the Marconi Company had done with the Chinese Government was under the three contracts in question in this action and the third contract had been violated by the Chinese Government because it first gave a monopoly to the Marconi Company and then gave a contract to an American firm to the amount of many millions sterling. The Marconi Company was disputing the right of the Chinese Government to enter into that contract.

Mr. Jowitt said the Marconi Company had never disputed that plaintiff was entitled to commission at five per cent. on £66,000 in respect of the second contract when the Marconi Company got payment under that contract.

His Lordship said he would give judgment at a subsequent date.

British Thomson-Houston Litigation.

In the Chancery Division on March 21st, Mr. Justice Lawrence heard the case of the British Thomson-Houston Company v. Hessler & Co. on a motion for judgment by the plaintiffs in default of appearance by the defendants in an action by the plaintiffs for an injunction to restrain an infringement of their drawn wire patent.

Mr. Justice Lawrence gave judgment for the plaintiff company with solicitor and client costs.

In a second action by the same plaintiffs against Delmerick's his Lordship gave a similar judgment in an action for an injunction to prevent the infringement of the plaintiffs' leading-in wire patent.

The British Thomson-Houston Co., Ltd., v. The Commercial Electrical Co., Ltd.

This action came before the Court of Appeal consisting of the Master of the Rolls and Lords Justices Atkin and Sargant, upon the appeal of the defendants from the refusal of Mr. Justice Tomlin to postpone the hearing of the action brought against them by the plaintiff company for the alleged infringement of its patent of 1909 in respect of tungsten filament for lamps, pending the appeal of the defendants from the judgment of Mr. Justice Russell in the action brought by the British Thomson-Houston Company against British Insulated and Helsby Cables, Ltd., in respect of the same patent.

Sir Duncan Kerly, K.C., in support of the appeal, said that he represented the defendants in 33 actions brought against them by the British Thomson-Houston Company, and these actions were at the present time in the list for hearing. In every one of those cases the question of validity of the British Thomson-Houston Company's 1909 patent arose. If the company failed in the appeal which was pending to support the validity of its patent then it must fail in all the other actions. He was quite prepared to assent on behalf of those defendants that the evidence in the Helsby action should be taken as evidence in each of the others. He submitted that he ought not to be forced in every one of these cases to call his evi-

dence all over again. In their view the royalties due to the plaintiffs in the event of the appeal in the Helsby case failing would be in the neighbourhood of £1,000,000.

SIR ARTHUR COLEFAX, K.C., on behalf of the respondents, opposed the postponement of the actions. He said that with the exception of the Helsby Company practically the whole of the lamp manufacturers were licensees under the 1909 patent. He contended that if the postponement of any one of the actions was directed it would have to be on the terms that a proper sum was brought into Court to cover the damages for infringement and an undertaking not to undersell, which would have the effect of dislocating the market. There was clear evidence that the defendants, the Commercial Electric Company, had been underselling the plaintiff company. He thought it was very doubtful if the plaintiffs would ever get any damages out of most of the defendants. Of course that remark did not apply to the Helsby Company. If the defendants in the 33 cases would undertake not to infringe further, pending the hearing of the appeal, he would not object to postponement. He also thought some money ought to be brought into Court and that the defendants should keep an account.

In the result their Lordships decided that they could only consider the question of postponement so far as it affected the Commercial Electric Company, the only defendant then before the Court.

The MASTER OF THE ROLLS, in giving judgment, said that he thought that the hearing of the action against that company ought to be postponed until 14 days after the judgment of the Court of Appeal upon the appeal of the Helsby Company. The terms of that postponement would be that those defendants in the meantime would keep a full account of all sales in which it was claimed that infringement was caused, and that the defendants should give an undertaking not to sell any incandescent electric lamps containing tungsten filaments alleged to infringe the plaintiffs' patent. The appeal would be allowed, the costs of the appeal being made costs in the action.

The Rating of Electric Signs.

IN the Glasgow Valuation Appeal Court, on March 17th, Messrs. Treron, Ltd., appealed against the entry on the Valuation Roll of two electric signs at their premises in Sauchiehall Street. For the appellants it was pointed out that the signs were not rented, and that they simply consisted of the name of the firm in lights instead of in paint. The Corporation was seeking to encourage the use of signs by means of reduced rates, but if they were to be rated the system would not make much headway. The Assessor claimed that an electric sign was an erection put up by the tenant.

The Court upheld the Assessor's contention, and dismissed the appeal.

Parliamentary.

(By Our Special Parliamentary Reporter.)

The Severn Barrage Scheme.—On March 17th, in reply to Mr. MILLS, who asked if the Cabinet had considered the question of the Severn barrage scheme in its relation to the unemployment of skilled workers, and, if so, would this work be put in hand at once, Mr. ALEXANDER, Parliamentary Secretary to the Board of Trade, said that on February 17th the President of the Board of Trade pointed out that, in view of the nature of the preliminary investigations which were necessary, the scheme, even if found to be practicable, could not be of assistance in reducing unemployment in the near future.

The Beachley Power Station.—On March 17th, Mr. WIGNALL asked the President of the Board of Trade if it was the intention of the Government to close down the power house at Beachley, Gloucester; and, if so, would he state the reason why.

Mr. ALEXANDER said that this power station was one of the items connected with the National Shipyards which the Board of Trade had to liquidate, and it was only being kept open for liquidation purposes. He could not say yet how soon it would be possible to close the station.

Private Bills.—The London County Council (Tramways and Improvements) Bill and the Chatham & District Light Railways Co. Bill have been read a second time in the House of Commons.

Grampian Electricity Supply Bill.—This Bill, the object of which is to confer further powers on the Grampian Electricity Supply Company, has been presented and read a first time in the House of Commons.

Lanarkshire Hydro-Electric Power Bill.—This Bill was read a second time in the House of Lords on March 18th.

Industrial Councils.—In reply to Mr. RAFFETY, Mr. SHAW, the Minister of Labour, stated that the number of Joint Industrial Councils now in existence was 70, and there were, in addition, many District Councils in active operation. In the case of 27 National Councils no recent meetings had been held.

Proposed New Broadcasting Station.—On March 17th, Mr. HARTSHORN informed Sir F. WISE that the British Broadcasting Company had been authorised to conduct experiments in broadcasting from a medium-power station at Chelmsford. The question whether a high power broadcasting station should be established permanently, and, if so, in what locality, would be considered when the results of the experiments were known. It was understood, however, that Chelmsford would not be a suitable locality for a permanent station of this kind, and that the Company did not contemplate purchasing property there.

Empire Wireless Chain.—On March 18th, Mr. HARTSHORN informed Sir H. BRITTAIN that the question of what action the Government would take on the report of the Wireless Telegraphy Committee, 1924, was still under consideration, but it was hoped to make an announcement at an early date.

Western Electric Company.—On March 18th, Mr. SNELL asked the Postmaster-General whether he was aware that the Western Electric Company, Limited, North Woolwich, who were large contractors for his department, continued to victimise numbers of men of established competency, character, and long service who were locked out by the firm in the overtime dispute in 1922.

Mr. HARTSHORN said he had no information on this subject, and it was not one in which he could intervene.

Mr. MILLS asked if the Postmaster-General would cause inquiries to be made into the personnel, conditions, and wages of the workpeople employed by the Western Electric Company in its new subsidiary works at New Southgate in relation to the fair-wage clause operating with all Government contracts. Mr. HARTSHORN said that he would have inquiries made.

Lead Poisoning.—On March 20th, Mr. HENDERSON, Home Secretary, in the course of a reply to a question by Lord H. CAVENDISH-BENTINCK, said that in 1923 there were 95 cases of lead-poisoning (2 fatal) in the electrical accumulator industry. In January and February, 1924, the number of cases was 18 (none fatal).

Mine Accidents and Profits.—On March 20th, Mr. SHINWELL, Secretary for Mines, informed Mr. BATEY that there were 1,162 fatal accidents in mines during 1923 in which 1,308 persons were killed. He had not the figures of non-fatal accidents yet. Profits in the coal-mining industry for the calendar year 1923 were approximately £26,150,000.

London County Council (General Powers) Bill.—This Bill came before a Committee of the House of Commons on March 21st. A great deal of discussion arose upon the question of the allocation of the profits from municipal electricity undertakings. The L.C.C. sought to include in the Bill a clause permitting these undertakings to apply their surpluses to the purchase of mains, machinery, fittings, etc., if they thought fit, instead of contributing to the relief of rates. Opposition to the clause was forthcoming from the Gas Light & Coke Co., the South Metropolitan Gas Co., and the Commercial Gas Co. The Hon. EVAN CHARTERIS, K.C. (for the London County Council) said that under existing statutes municipal electricity undertakings could devote the whole of their surplus to the repayment of old loans, but if they wanted new plant they had to raise new loans, probably at a higher rate of interest. The new clause would enable them to spend the surplus on new plant if they considered it more economical. Similar facilities had already been granted to Leeds, St. Marylebone, West Bromwich, Tunbridge Wells, and other municipalities. Counsel pointed out that the disposal of the surplus in this way was subject to the agreement of the Electricity Commissioners. If a municipal council desired it, the surplus could still be used for the relief of rates; it was a matter of policy. The gas companies, in their petition, contended that as many municipal undertakings had incurred losses, which were made good from the rates, they were compelled, as large ratepayers, to contribute to the upkeep of competitive concerns. If surpluses were used as suggested, only the consumers of electricity would benefit. The Hon. EVAN CHARTERIS, commenting upon this, said that it was reasonable when a power which would lead to more economical management of a municipal undertaking was asked for, a power which would be possessed by any commercial undertaking, that that power should be granted.

Mr. EDWIN AUSTIN (Town Clerk, Battersea), said that the Battersea undertaking had repaid all moneys taken from the rates. Requiring new plant, it was forced to pay off £10,000 of old loan and raise a new loan of the same amount. This it was empowered to do by the use of its surplus, which would again not benefit the general ratepayer. Speaking of the general position, Mr. AUSTIN said that six Metropolitan boroughs had an accumulated net deficit of £273,830, while the rest had not only repaid all deficits incurred in previous years, but in addition had handed over £228,664 to the rates.

The Metropolitan Boroughs Standing Joint Committee and the Institute of Municipal Treasurers and Accountants were stated to be in favour of the clause.

Mr. TYLDESLEY JONES (for the gas companies) said that the municipal undertakings were not bound to repay borrowings from the rates, and this clause would give them another option. The gas companies had to contribute towards losses, and there was no obligation upon the electricity undertakings to restore a penny to the ratepayers.

Mr. Leslie Gordon (Town Clerk, Hammersmith, and hon. secretary to the Conference of Local Authorities Owning Electricity Undertakings in Greater London) said that Hammersmith and the borough councils generally were for the granting of this clause. The power of dealing with surplus profits in this way would increase the profitability of the undertakings so that they would be an advantage to the general body of the people; it was a practicable business "proposition."

Mr. Tyldesley Jones said that gas companies were restricted by law from spending revenue for capital purposes. The use of their surpluses by electricity undertakings for capital purposes would reduce their interest and sinking fund charges, and they could charge consumers less. The competition between gas and electricity undertakings was so keen that the ability to supply fittings more cheaply might just turn the scale in favour of one or the other. He considered that this clause gave the electricity undertakings an unfair advantage. He suggested that the clause might provide that no money should be applied otherwise than in the relief of rates until any sums taken from the rates had been repaid.

The Hon. Evan Charteris said that the Metropolitan borough councils would be willing to accept a provision that any expenditure should be subject to the sanction of the Electricity Commissioners, and after consideration the Committee passed the clause subject to this proviso.

Physical Society of London.

Jubilee Banquet.

Nearly every branch of science was represented at the jubilee banquet of the Physical Society of London, on March 22nd, when Mr. F. E. Smith, C.B.E., F.R.S., presided over a gathering of some 400 distinguished scientists, guests, and representatives of British and foreign societies and institutions.

In his reply to the loyal toasts, the Duke of York, K.G., said he was glad to know that there were present that evening four of the original Fellows of the Society, which was formed in 1874. The international aspect of its work could not fail to appeal to those who, like himself, were impelled to the belief that scientific discoveries were inevitably to be regarded as the possession of the whole civilised world, and could never be considered the monopoly of any one country, nation, or people.

Mr. J. Ramsay MacDonald, M.P., Prime Minister, explained that one reason why he had been asked to toast the "Physical Society of London" was a certain family connection. The first president of the Society—and the first among a group of founders of the Society—was the late Dr. Gladstone, his father-in-law. He could remember, when he started, what a glorious inspiration science was, not to the scientific man only, but to the man who intended to live a strenuous and useful life. In those days Huxley and Tyndall were alive. Their pronouncements in those days gave their readers a great inspiration. This generation, in its thought and action, owed more than tongue could tell to the scientific impetus given by the men who explored those subject 40 and 50 years ago. He believed the day of the great simplicist was beginning to dawn again, that the time was about to come when a scientist would appear who was an expert of the experts, with a wide comprehending co-ordinating mind that would take up all the work of the scientist and show how it tended to the establishment of a unity of idea and a unity of law. His conception of the House of Commons was that it was a sort of British Association, something like a Friday evening lecture at the Royal Institution. The departments behind the scenes, connecting with the lecture rooms with a lift, with an expert who made the electrical connections, were the laboratories. If they went into the Government Departments and saw how they used an hypothesis, and applied it to experience by way of experiment, and how the results were recorded, explained, made definite in legislation, and finally created into the foundations of further hypotheses, which again went through the same process, they would find that, so far from the politician being an outsider, he was a fellow-worker with themselves.

The Chairman, in replying, said that the Society had walked through life demurely; fifty years ago it started with 99 Fellows, but now had a membership of 600. Delegates from many foreign countries had attended their jubilee celebrations and they had received congratulatory messages from all over the world, including Russia. They had many valuable books which were not accessible to members and they were homeless—which was also the plight of many other institutions. Perhaps some day they might have one central home.

Viscount Haldane, K.T., O.M., F.R.S., the Lord Chancellor, proposed "Kindred Societies," remarking that science had taught a great lesson, for in science the nations were almost as one. Where there were clear conceptions there was no room for any distinction or racial bias. That was a pregnant fact, and it ought to be borne in mind in settling the vexed problem of statecraft all over the world.

Sir R. T. Glazebrook, K.C.B., F.R.S., in responding, said that they heard much of key industries; was not physics the key science? It would unlock the door and allow them to pass through. The application of physics was in evidence throughout industry; all engineering would be insecure unless based on a substantial substructure of mathematics and physics.

Prof. C. Fabry, president of the Société Française de Physique, referred to the international character of science and the desirability of closer connection between men of science of all countries.

After Sir Oliver Lodge had also briefly responded, "The Visitors" were toasted by Prof. Sir J. J. Thomson; on their behalf Sir J. Cook, High Commissioner of the Australian Commonwealth, and Mr. J. H. Jeans (Sec., R.S.), representing the Carnegie Institution of Washington, responded. The health of the chairman was proposed by Prof. Sir E. Rutherford and Mr. F. E. Smith briefly acknowledged the toast. The presence of ladies contributed to the success of the function.

Published Specifications.

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Patent Agents.

The name of the applicant's patent agent, if any, will be found on the printed specification.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1922.

23,655. "Control of trains." A. R. Angus. December 13th, 1921. (190,447.)

23,669. "Radio-receiving apparatus specially suitable for use in wireless telephony." E. A. Graham. August 31st, 1922. (211,903.)

24,879. "Automatic telephone exchange." E. A. Faller. September 25th, 1922. (211,909.)

29,387. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. April 5th, 1922. (Addition to 169,698.) (195,328.)

31,286. "Sanding devices for electrically-propelled vehicles." P. Priestly. November 16th, 1922. (211,922.)

32,372. "Electric safety combination lock." L. Cadenel. November 27th, 1922. (211,933.)

32,384. "Apparatus for making and breaking the circuit of an electric horn." H. J. Waller and Eural Patents, Ltd. November 27th, 1922. (211,934.)

32,395. "Telegraphic receiving apparatus." Creed & Co., Ltd., and J. R. Worthington. November 27th, 1922. (211,935.)

32,452. "Thermionic valves." G. E. Stubbs, E. S. Brown, and F. Warner. November 28th, 1922. (Cognate application, 16,367/23.) (211,940.)

32,527. "Electrolisers." J. P. Scott. November 28th, 1922. (211,946.)

32,611. "System of control for maintaining the relative speeds of a number of electric motors." F. G. Warburton. November 29th, 1922. (211,953.)

32,878. "Telephone systems." Relay Automatic Telephone Co., Ltd., and B. B. Johnson. December 1st, 1922. (211,974.)

33,327. "Telephone earpieces." J. Kelly. December 6th, 1922. (211,984.)

33,421. "Transmission of audible code signals for fire-alarm and like purposes." C. Smith and G. J. Sutton. December 7th, 1922. (211,985.)

34,098. "Switch mechanism for use in electric lighting installations." C. Sugden. December 14th, 1922. (211,998.)

34,214. "Means for controlling the head-lights of motor vehicles and the like." B. L. Roberts and J. Judge. December 15th, 1922. (212,000.)

34,729. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., and A. A. Pollock. December 20th, 1922. (212,008.)

35,179. "Devices for making and breaking electric circuits." T. Zweigbergk. December 27th, 1922. (212,011.)

35,496. "Electric circuit breakers." D. R. Davies and Metropolitan-Vickers Electrical Co., Ltd. December 30th, 1922. (212,016.)

1923.

1,769. "High-tension electrical switchgear." D. R. Davies and Metropolitan-Vickers Electrical Co., Ltd. January 19th, 1923. (212,039.)

3,437. "Automatic or semi-automatic telephone exchanges." G. H. Janson. February 4th, 1922. (192,712.)

3,525. "Electric discharge indicators." British Thomson-Houston Co., Ltd. February 11th, 1922. (193,041.)

4,181. "Masts, or posts, particularly suitable for supporting aerials for wireless telegraphy." Accles & Pollock, Ltd., and W. W. Hackett. February 13th, 1923. (212,067.)

4,253. "Adjustable chair or support for tramway or railway rail joints." J. H. Hawke. February 13th, 1923. (212,069.)

4,613. "Wireless apparatus." M. Billington. February 16th, 1923. (212,076.)

5,200. "Electrical controllers." R. Amberton. February 22nd, 1923. (212,089.)

5,597. "Inductance devices and methods of making the same." American Radio and Research Corporation. February 24th, 1922. (193,873.)

5,938. "Perforators used in connection with automatic telegraphy." Elliott Bros. (London), Ltd., and H. H. Elliss. March 1st, 1923. (212,100.)

6,773. "Synchronised asynchronous machines." Compagnie Générale Electrique. April 22nd, 1922. (196,586.)

7,252. "Electric furnace melting of manganese steel scrap." F. C. R. Marks (American Manganese Steel Co.). March 13th, 1923. (212,121.)

8,173. "Electroscopes." C. E. Snell. March 22nd, 1923. (212,129.)

8,829. "Cut-out insulators for electric circuits." J. N. Robinson. May 26th, 1922. (198,341.)

14,746. "Suspensions for electric lighting fixtures." L. Erikson. June 5th, 1923. (212,173.)

15,993. "Selective and anti-parasitic receiving systems for electromagnetic waves and electric currents of constant frequency." Marrec, Ltd., and Y. Marrec. June 19th, 1923. (212,177.)

16,743. "Electric lighting for vehicles." L. J. C. Tolmer. June 28th, 1922. (200,096.)

18,975. "Electric control apparatus for illuminated signs." L. Roth. July 24th, 1923. (212,186.)

19,397. "Dynamo-electric driving sets, such as are used for motor-propelled vehicles." Dr. F. Porsche. July 29th, 1922. (201,571.)

20,469. "Radio receiving systems." Marconi's Wireless Telegraph Co., Ltd. August 12th, 1922. (202,320.)

22,008. "Electric furnaces." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric and Manufacturing Co.). August 31st, 1923. (212,190.)

22,009. "Electric furnaces." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric and Manufacturing Co.). August 31st, 1923. (212,191.)

23,464. "Apparatus for operating high-vacuum mercury-vapour gas ejectors in connection with mercury-vapour rectifiers." Akt. Ges. Brown, Boveri et Cie. September 25th, 1922. (204,332.)

25,367. "Variable electric condenser." A. Courtecuisse. October 11th, 1923. (212,199.)

28,653. "Means for eliminating disturbing electrical oscillations." Ges. für Drahtlose Telegraphie. November 8th, 1922. (206,838.)

28,631. "Attachment of blades in railway switches." A. J. Stephens (Elektriska Svetsnings Aktiebolaget). November 13th, 1923. (212,204.)

28,884. "Variable electric condensers having interleaving plates." British Thomson-Houston Co., Ltd. (General Electric Co.). November 15th, 1923. (212,205.)

29,296. "Dynamo-electric machines." Metropolitan-Vickers Electrical Co., Ltd. December 2nd, 1922. (207,806.)

1924.

744. "Binaural apparatus for testing the simultaneity of sounds and like purposes." Submarine Signal Corporation. January 11th, 1923. (209,745.)